CHAPTER 29

LIST OF EFFECTIVE TEMPORARY REVISIONS

FOLLOWING IS A COMPLETE LISTING OF ALL ACTIVE TEMPORARY REVISIONS (TR'S). TR'S NOT LISTED SHOULD BE REMOVED. THE ATA NUMBER, CONFIG CODE AND PAGE NUMBER IDENTIFIES THE PAGE PRECEDING THE TR.

TR NUMBER	ATA NUMBER	CONFIG CODE	PAGE NUMBER	TR DATE

NONE

CHAPTER 29

HYDRAULIC POWER

LIST OF EFFECTIVE PAGES

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29-conts	2	Jun 15/92	
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29-DIAGM	3	Feb 15/82	
29-DIAGM	4	Feb 15/82	
29-DIAGM	5	Dec 15/91	
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29-DIAGM	7	Jul 15/84	
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29-INDEX	5	Dec 15/93	
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29-00-00	606	Jun 15/92	
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29-00-00	608	May 15/86	
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29-00-99	202	Aug 15/81	

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29-11-00	15/16	Jun 15/92	
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29-11-00	20	May 15/82	
29-11-00	21/22	May 15/82	
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29-11-00	53	Mar 15/91	
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29-11-00	61/62	Mar 15/91	
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29-11-00	64	Mar 15/91	
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29-11-00	68	Dec 15/91	
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29-11-00	114	Mar 15/91	
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29-11-00	117	Mar 15/91	
29-11-00	118	Mar 15/91	
29-11-00	119	Mar 15/91	
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29-11-00	121	Dec 15/91	
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29-11-00	126	Mar 15/91	
29-11-00	127	Mar 15/91	
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29-11-00	206	Nov 15/85	
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29-11-00	614	Dec 15/93	
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29-11-85	401	Sep 15/79	
29-11-85	402	Sep 15/79	
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R	29-21-00	506	Jun 15/96	
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R	29-21-00	511	Jun 15/96	
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	29-21-10	204	Feb 15/74	
	29-21-10	401	Sep 15/80	
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	29-21-12	403	Mar 15/91	
	29-21-12	404	Mar 15/91	
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29-21-18	402	Aug 15/81	
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29-31-00	2	May 15/73	
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29-32-02	402	Nov 15/83	
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29-32-03	403/404	May 1/72	
29-32-06	401	Sep 15/79	
29-32-06	402	May 15/76	
29-33-00	1/2	Dec 1/72	
29-33-00	3/4	Dec 1/71	
29-33-00	201/202	Mar 15/81	
29-34-00	1	Nov 15/83	
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CHAPTER 29

HYDRAULIC POWER

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R				SB29-056
R				PART 2
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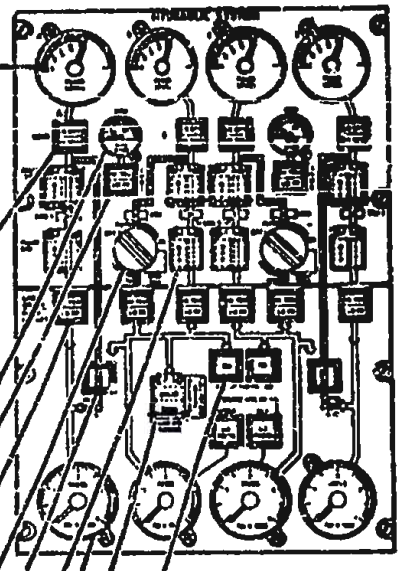

ATM FAULT LIGHTS
ENGINE-DRIVEN PUMPS
AC PUMP ABNORMAL OPERATION
HYDRAULIC SYSTEM FLUID LOSS

ATM FAULT LIGHTS
ENGINE-DRIVEN PUMPS
AC PUMP ABNORMAL OPERATION
HYDRAULIC SYSTEM FLUID LOSS

ATM FAULT LIGHTS
ATM ABNORMAL OPERATION

ATM FAULT LIGHTS
ATM ABNORMAL OPERATION
ENGINE-DRIVEN PUMPS

ATM ABNORMAL OPERATION

AC PUMPS ABNORMAL OPERATION
PTU FAILURE

ENGINE-DRIVEN PUMPS

ATM FAULT LIGHTS
ENGINE-DRIVEN PUMPS
AC PUMP ABNORMAL OPERATIONS
PTU FAILURE
ATM ABNORMAL OPERATION

RAT OPERATION

AC PUMP ABNORMAL OPERATION

(FE/SO PANEL)

RAT OPERATION — RAT DEPLOYED

(CENTER INSTRUMENT PANEL)

M1-0002-29-2003

TITLE	CHAP/SEC
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ATM FAULT LIGHTS	2911
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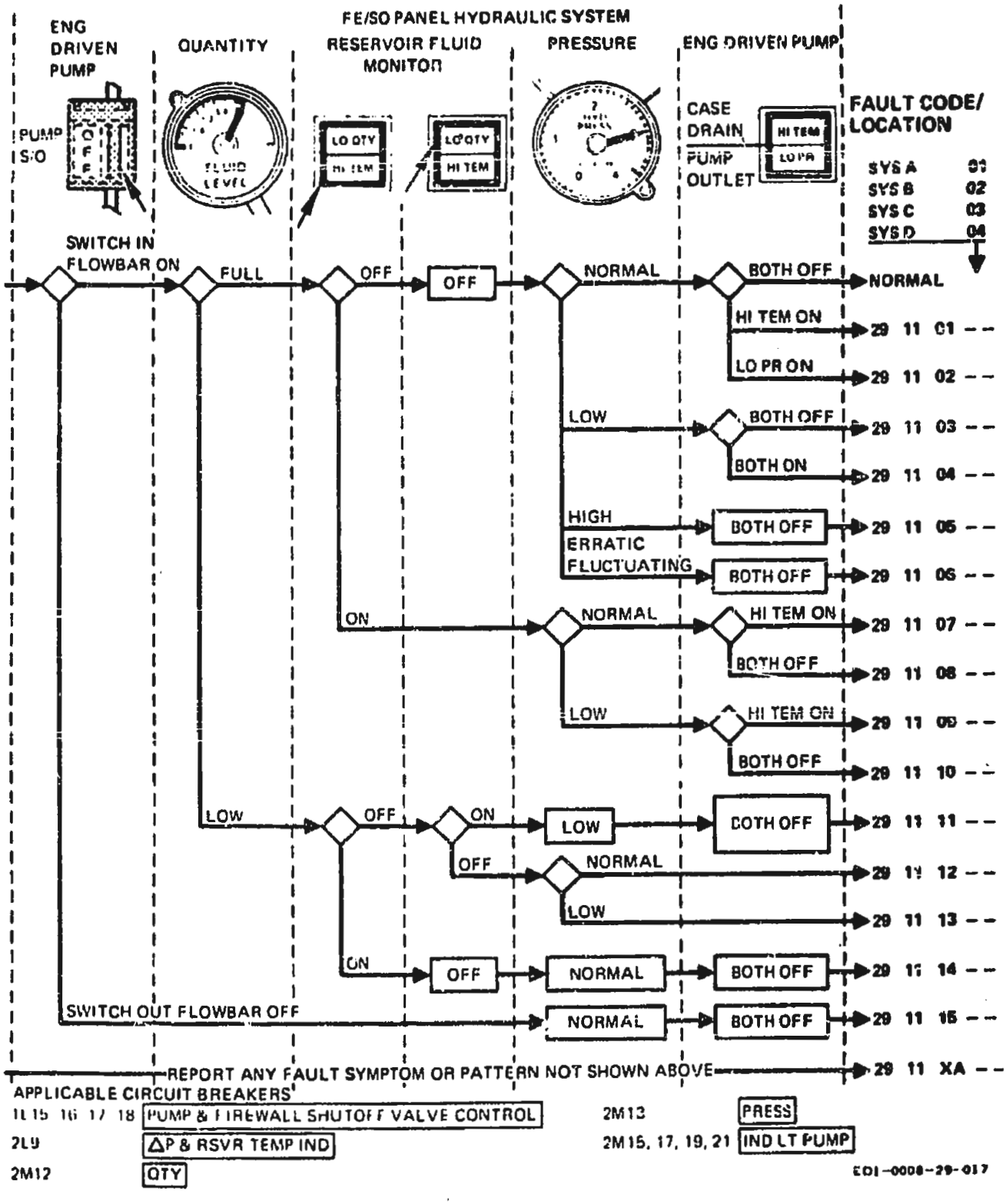
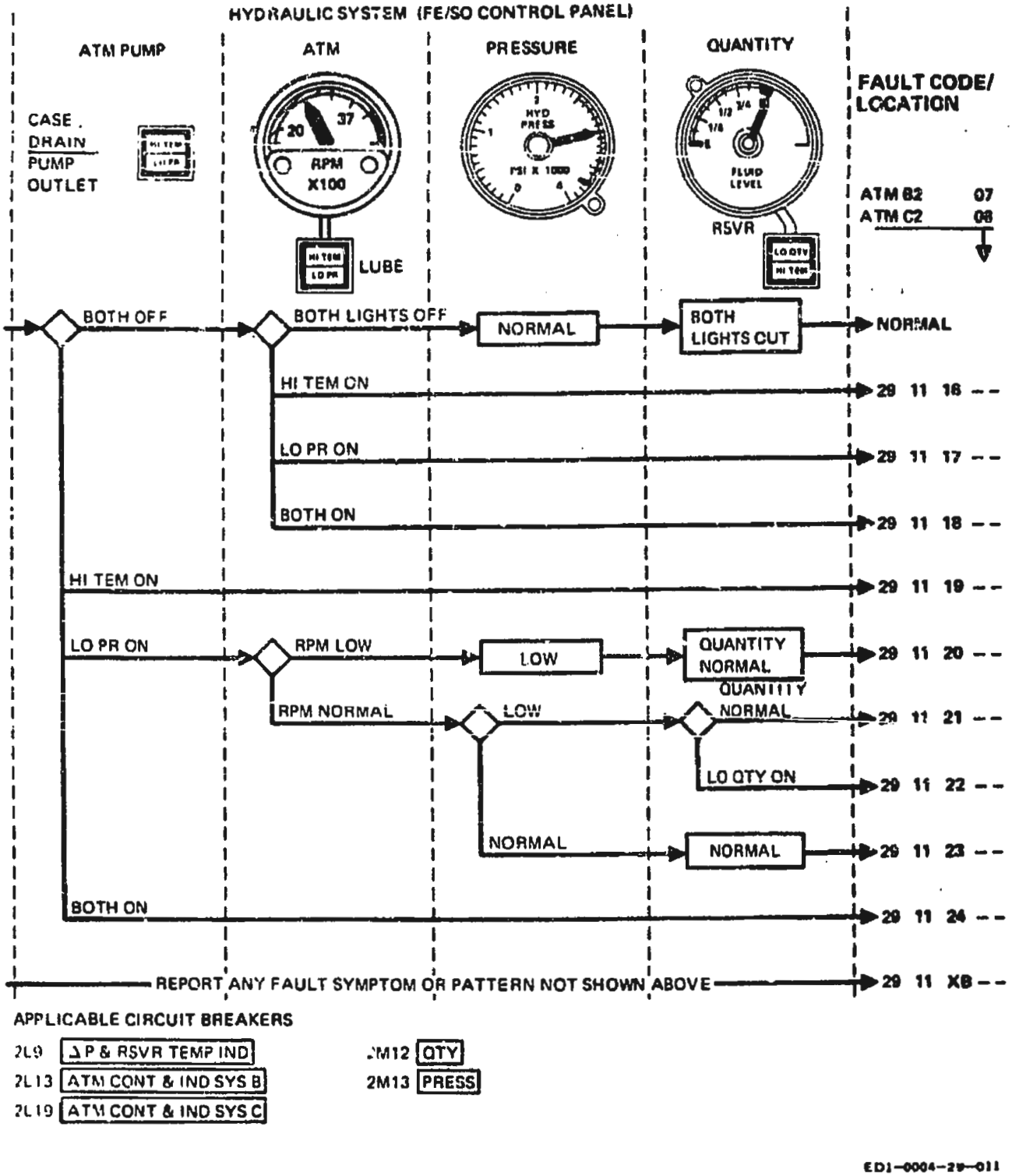


Engine-driven Pumps - Fault Codes
Figure 1

R EFFECTIVITY: ALL

29-FAULT CODE DIAGRAM

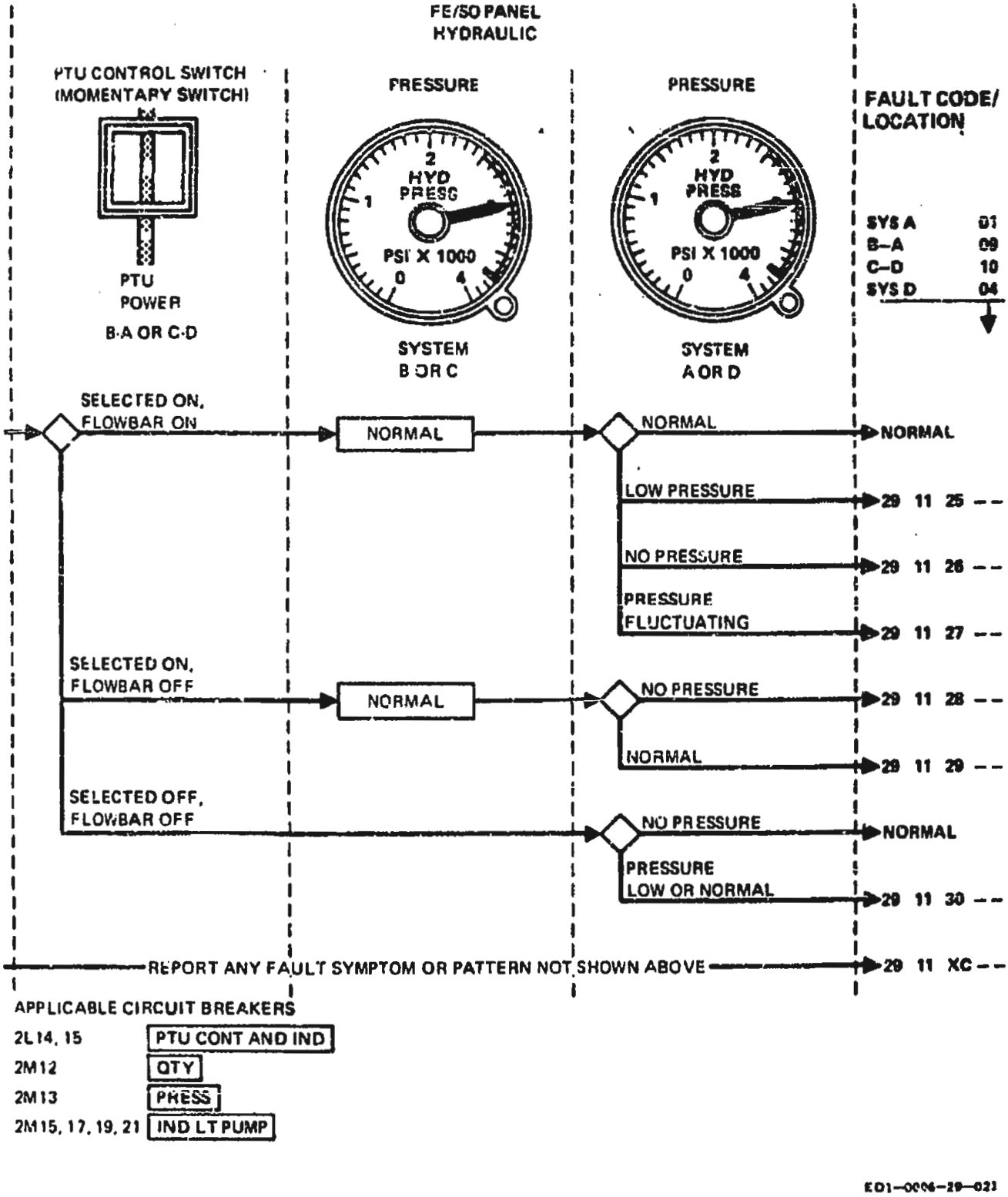


R ATM Fault Lights - Fault Codes
Figure 2

R EFFECTIVITY: ALL

050B

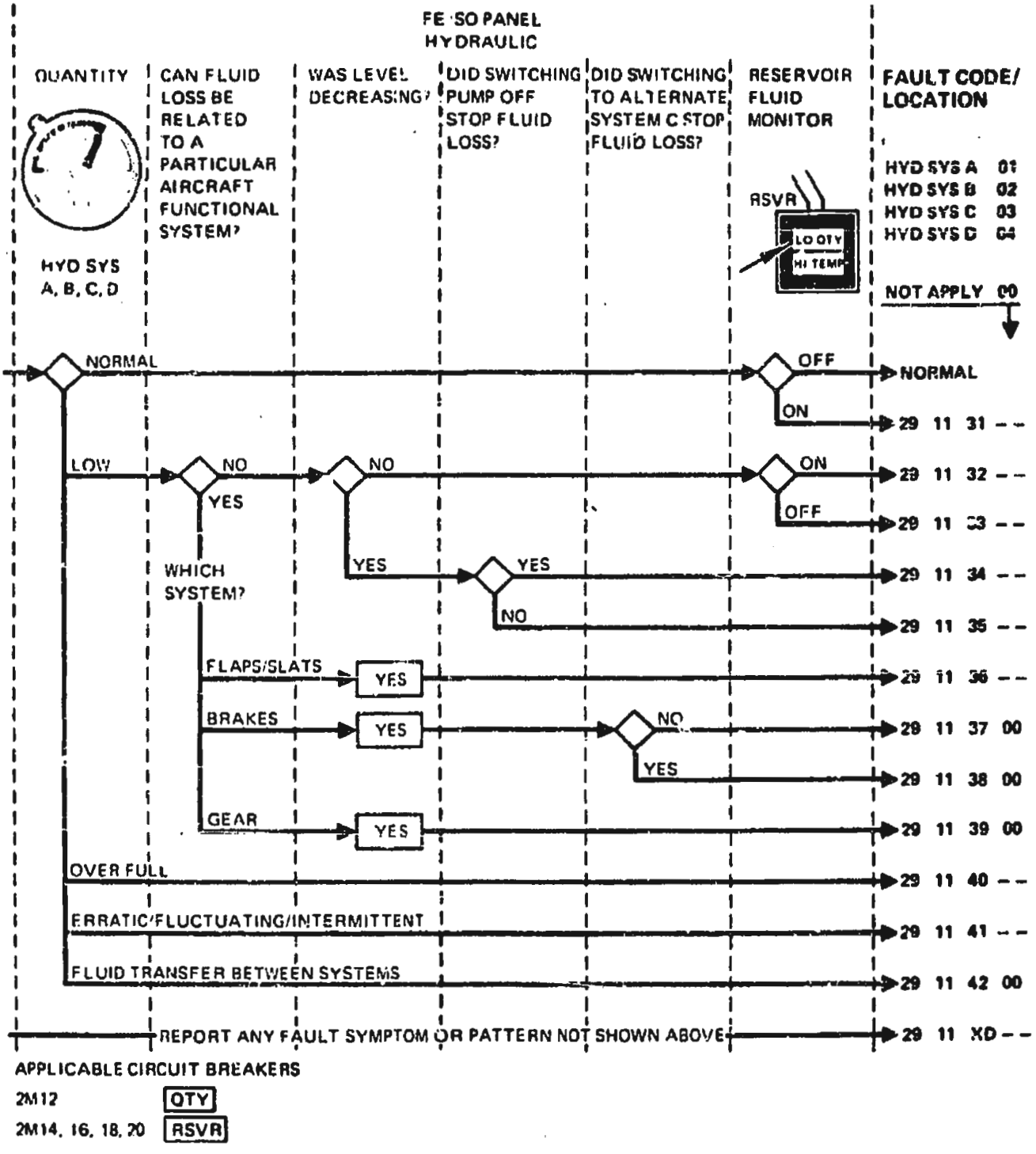
29-FAULT CODE DIAGRAM



R PTU Failure - Fault Codes
Figure 3

R EFFECTIVITY: ALL

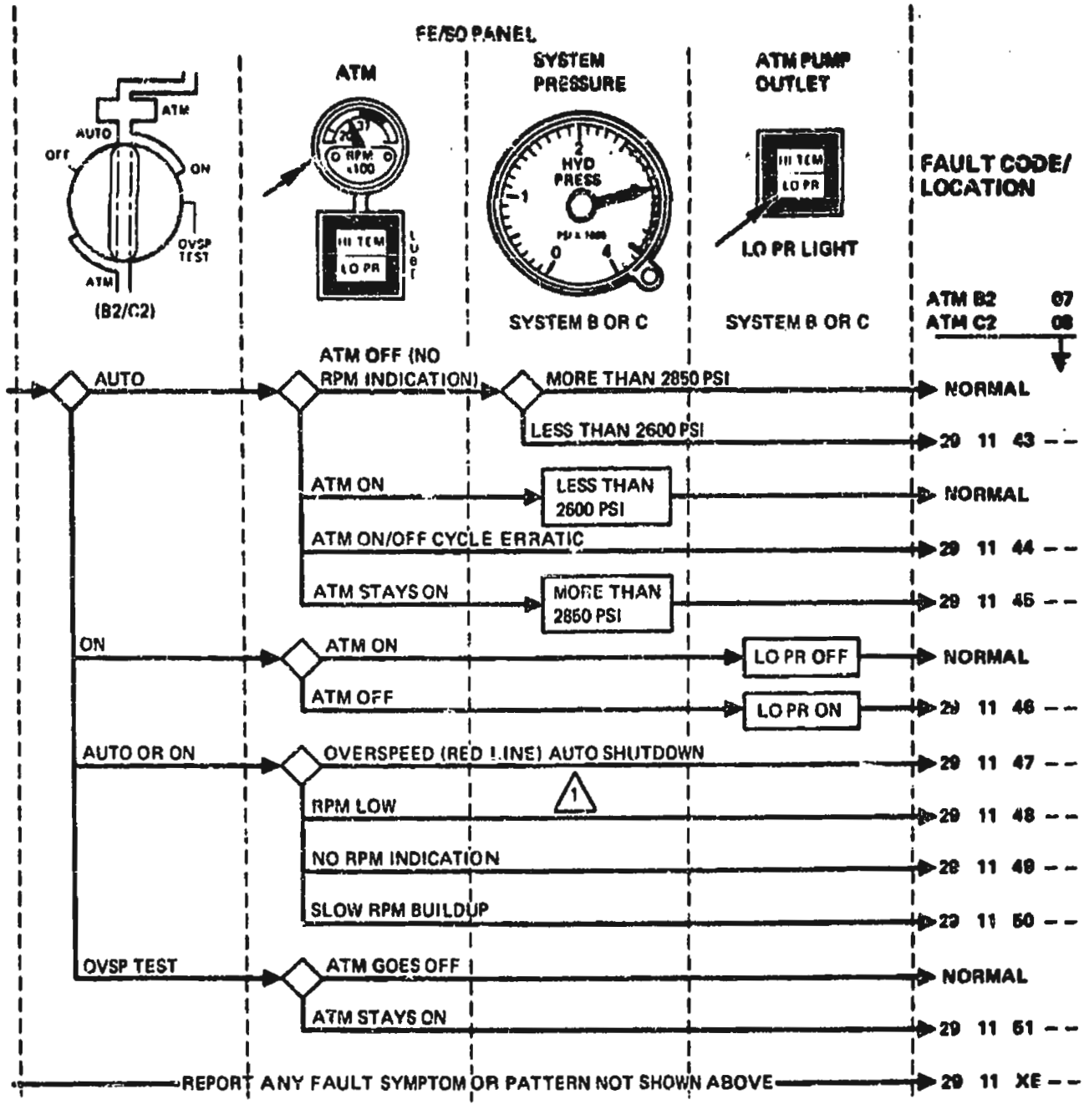
29-FAULT CODE DIAGRAM



R Hydraulic System Fluid Quantity - Fault Codes
Figure 4

R EFFECTIVITY: ALL

29-FAULT CODE DIAGRAM



APPLICABLE CIRCUIT BREAKERS

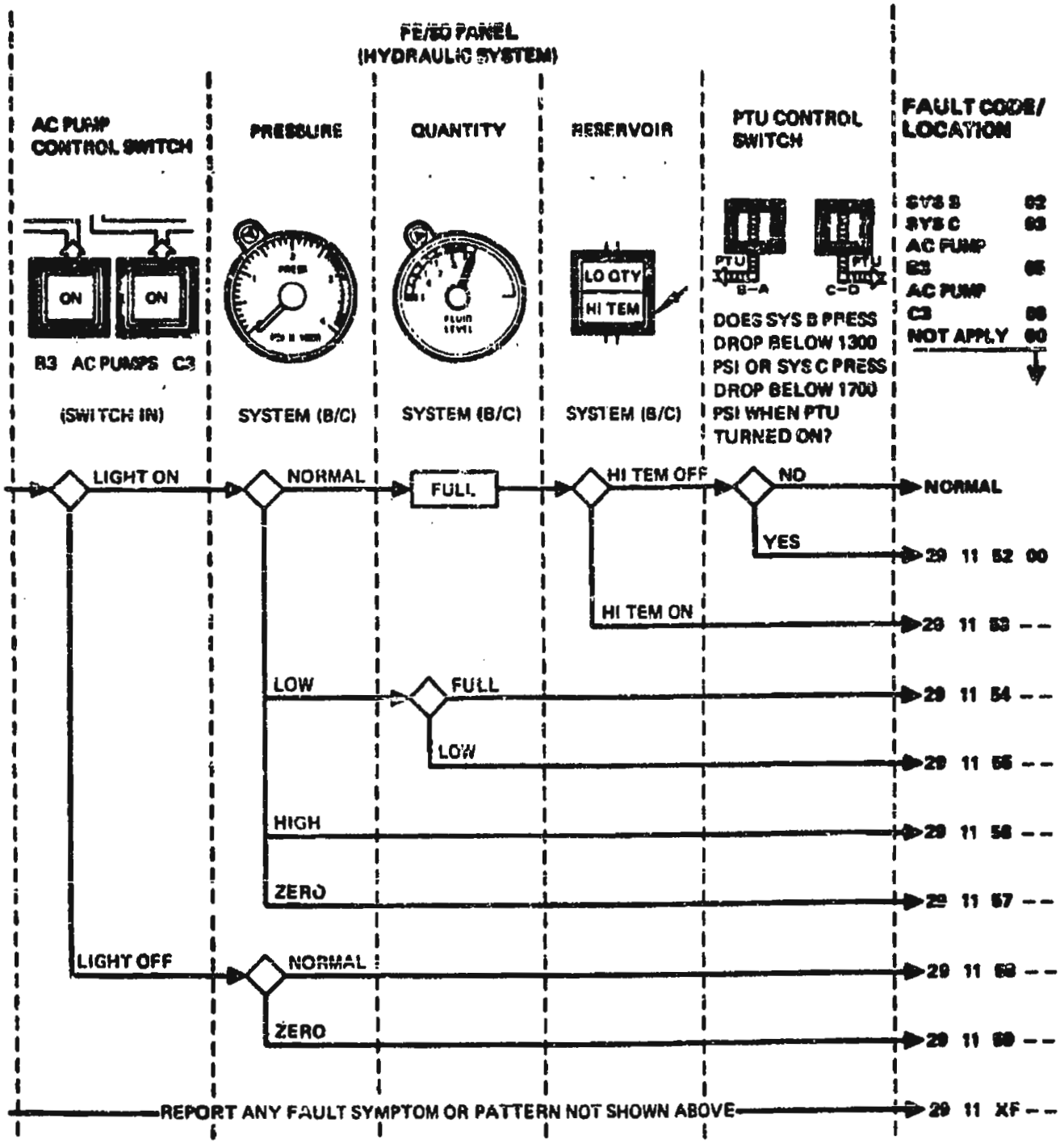
2L13	ATM PUMP CONT & IND SYS B
2L19	ATM PUMP CONT & IND SYS C

1 IF S/B 093-29-093 IS INCORPORATED, THE RPM MAY RUN IN THE MID TO HIGH YELLOW RANGE (OPERATION NORMAL).

ED1-0007-29-023

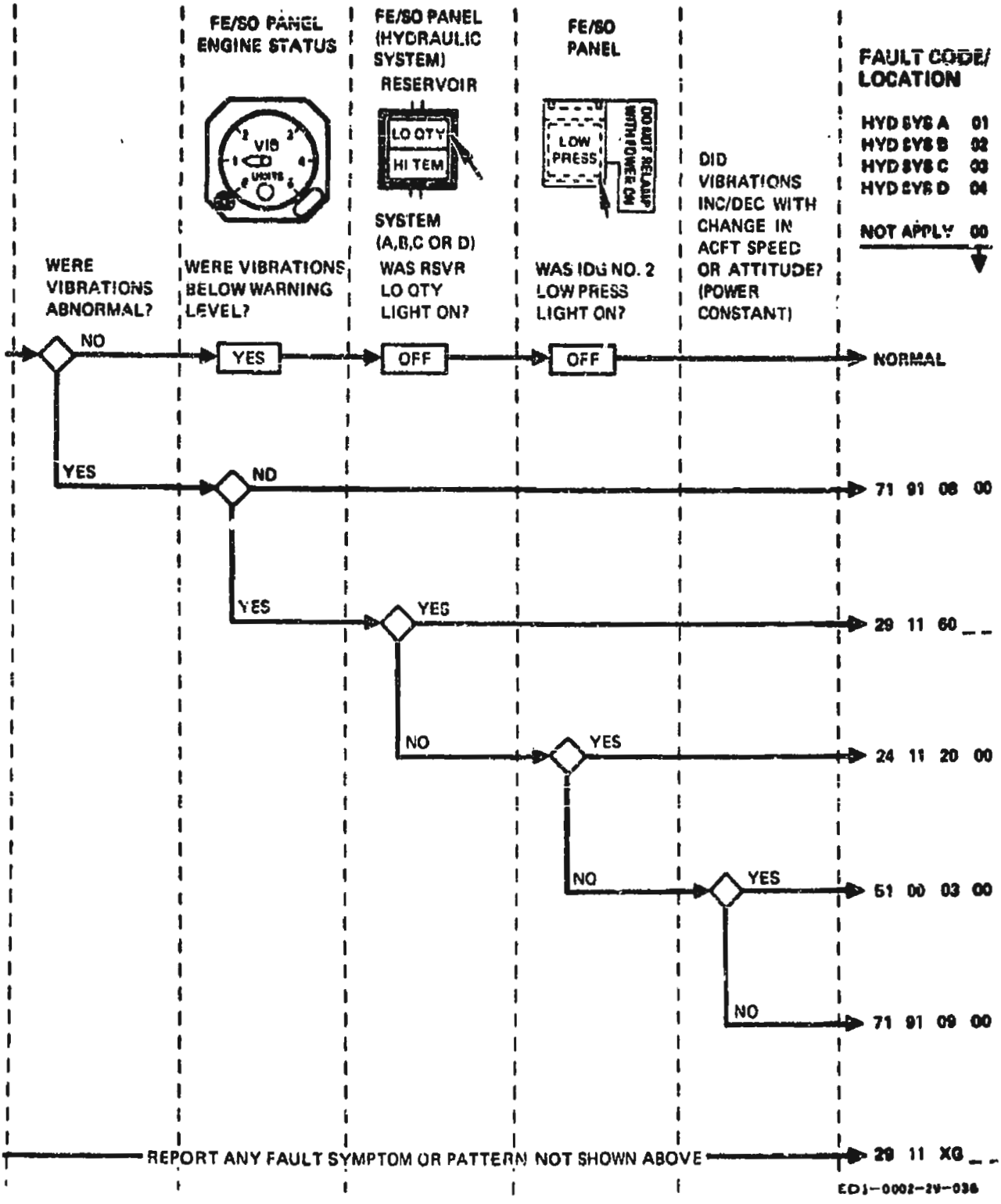
R ATM Abnormal Operation - Fault Codes
Figure 5

EFFECTIVITY: ALL

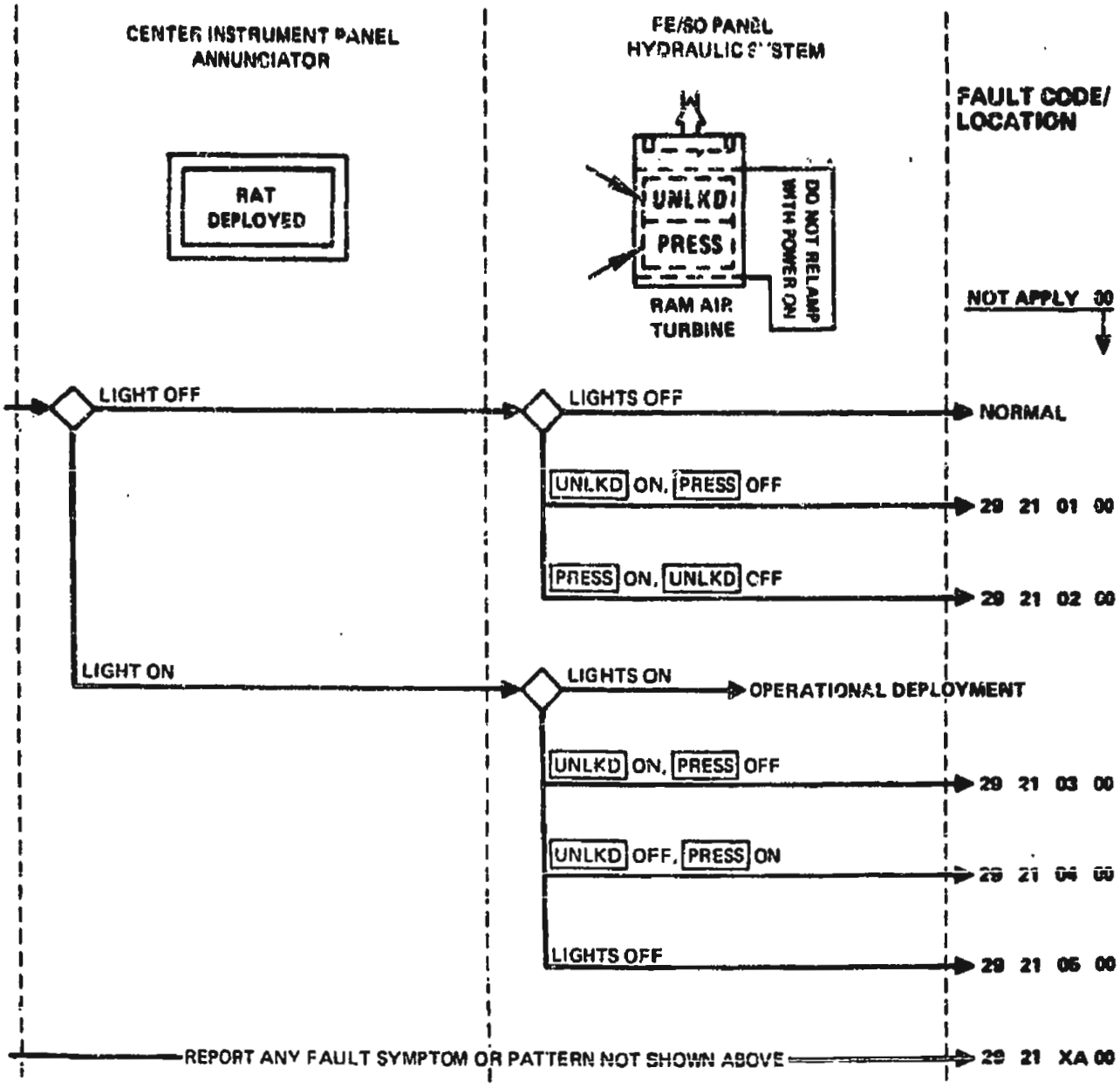


EDI-0003-29-034

R AC Pump Abnormal Operation - Fault Codes
Figure 6



R Aft Cabin Vibration - Fault Codes
Figure 7



APPLICABLE CIRCUIT BREAKERS

1B14	RAT MAN DEPLOY
3G10	IND LT RAT
1L3	RAT AUTO DEPLOY

ED1-0002-29-016

RAT Operation - Fault Codes
Figure 8

FAULT CODE INDEX
TABLE 1

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	29 11 XA __	1. An Engine-driven Pumps fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 29-11-00 Fig. 103 through 119 Block 1
	29 11 XB __	1. An ATM Fault Lights fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 29-11-00 Fig. 103 through 119 Block 1
	29 11 XC __	1. A PTU Failure fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 29-11-00 Fig. 103 through 119 Block 1
	29 11 XD __	1. An Hydraulic System Fluid Quantity fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 29-11-00 Fig. 103 through 119 Block 1
	29 11 XE __	1. An ATM Abnormal Operation fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 29-11-00 Fig. 103 through 119 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 XF __	1. An AC Pump Abnormal Operation fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 29-11-00 Fig. 103 through 119 Block 1
29 11 XG __	1. An Aft Cabin Vibration fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 29-11-00 Fig. 105 Block 1
29 21 XA 00	1. A RAT Operation fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 29-21-00 Fault Isolation
29 11 01 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) engine-driven pump case drain HI TEM light on. All other indications normal.
	2. 29-11-00 Fig. 104 Block 1
29 11 02 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) engine-driven pump LO PR light on. All other indications normal.
	2. 29-11-00 Fig. 103 Block 1
29 11 03 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) press indicates low, all other indications normal.
	2. 29-11-00 Fig. 117 Block 2

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 04 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) Sys press low, engine-driven pump case drain HI TEM and pump outlet LO PR lights on. All other indications normal. 2. 29-11-00 Fig. 104 Block 8
29 11 05 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) press indication high (above 3200 psi) with sys pressurized by engine-driven pump only. All other indications normal. 2. 29-11-00 Fig. 117 Block 3
29 11 06 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) press indication erratic/fluctuating. All other indications normal. 2. 29-11-00 Fig. 117 Block 4
29 11 07 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir and engine-driven pump case drain HI TEM lights on. All other indications normal. 2. 29-11-00 Fig. 104 Block 3
29 11 08 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir HI TEM light on. All other indications normal. 2. 29-11-00 Fig. 106 Block 3
29 11 09 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir HI TEM light on, sys press low and engine-driven pump case drain HI TEM light on. All other indications normal. 2. 29-11-00 Fig. 104 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 10 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir HI TEM light on and sys press low. All other indications normal. 2. 29-11-00 Fig. 106 Block 1
29 11 11 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir quantity low, reservoir LO QTY light on and sys press low. All other indications normal. 2. 29-11-00 Fig. 105 Block 1
29 11 12 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir quantity low. All other indications normal. 2. 29-11-00 Fig. 108 Block 3
29 11 13 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir quantity low and sys press low. All other indications normal. 2. 29-11-00 Fig. 107 (Sheet 2) Block 2
29 11 14 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir quantity low and reservoir HI TEM light on. All other indications normal. 2. 29-11-00 Fig. 106 Block 1
29 11 15 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) Hydr press does not go to zero psi when PUMP S/O switch positioned to off (switch out and flowbar off). No other pumps on. 2. 29-11-00 Fig. 118 Block 6
29 11 16 __	1. (07=B2, 08=C2) ATM lube monitor HI TEM light on. All other indications normal. 2. 29-11-00 Fig. 111 (Sheet 2) Block 5

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 17 __	1. (07=B2, 08=C2) ATM lube monitor LO PR light on. All other indications normal.
	2. 29-11-00 Fig. 111 (Sheet 2) Block 1
29 11 18 __	1. (07=B2, 08=C2) ATM lube monitor HI TEM and LO PR lights on. All other indications normal.
	2. 29-11-00 Fig. 111 (Sheet 2) Block 4 29-11-00 Fig. 111 (Sheet 2) Block 5
29 11 19 __	1. (07=B2, 08=C2) ATM pump monitor HI TEM light on. (Report other abnormal indications.)
	2. 29-11-00 Fig. 111 (Sheet 1) Block 2
29 11 20 __	1. (07=B2, 08=C2) ATM pump monitor pump outlet LO PR light on, ATM rpm low (__rpm) and sys press low. All other indications normal.
	2. 29-11-00 Fig. 111 (Sheet 1) Block 5
29 11 21 __	1. (07=B2, 08=C2) ATM pump monitor pump outlet LO PR light on and sys press low. All other indications normal.
	2. 29-11-00 Fig. 111 (Sheet 1) Block 5
29 11 22 __	1. (01=B2, 02=C2) ATM pump monitor LO PR light on. Sys press low and reservoir quantity low and reservoir LO QTY light on. All other indications normal.
	2. 29-11-00 Fig. 111 (Sheet 1) Block 1
29 11 23 __	1. (07=B2, 08=C2) ATM pump monitor pump outlet LO PR light on. All other indications normal.
	2. 29-11-00 Fig. 111 (Sheet 1) Block 5

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 24 __	1. (07=B2, 08=C2) ATM pump monitor HI TEM and LO PR lights on. (Report other abnormal indications.)
	2. 29-11-00 Fig. 111 Block 2
29 11 25 __	1. (01=Sys A, 04=Sys D) indicated low press with PTU selected and flowbar on. All other indications normal.
	2. 29-11-00 Fig. 112 Block 5
29 11 26 __	1. (01=Sys A, 04=Sys D) indicates no press with PTU selected and flowbar on. All other indications normal.
	2. 29-11-00 Fig. 112 Block 2
29 11 27 __	1. (01=Sys A, 04=Sys D) press fluctuating rapidly with PTU selected and flowbar on. All other indications normal.
	2. 29-11-00 Fig. 112 Block 6
29 11 28 __	1. (01=Sys A, 04=Sys D) indicates no press with PTU selected; flowbar off. All other indications normal.
	2. 29-11-00 Fig. 113 Block 10
29 11 29 __	1. (09=Sys B-A, 10=Sys C-D) PTU selected on; flowbar off. Sys press normal.
	2. 29-11-00 Fig. 113 Block 6
29 11 30 __	1. (01=Sys A, 04=Sys D) indicates low or normal press with PTU selected off. All other press sources for sys turned off.
	2. 29-11-00 Fig. 113 Block 8

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 31 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir LO QTY light on. Reservoir quantity normal. 2. 29-11-00 Fig. 105 Block 1
29 11 32 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir LO QTY light on. Reservoir quantity low and steady. 2. 29-11-00 Fig. 105 Block 1
29 11 33 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir quantity low and steady. LO QTY light off. 2. 29-11-00 Fig. 105 Block 2
29 11 34 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir quantity low and decreasing. Switching pump off stopped fluid loss. 2. 29-11-00 Fig. 108 Block 10
29 11 35 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir quantity low and decreasing. Switching pump off did not stop fluid loss. 2. 29-11-00 Fig. 108 Block 3
29 11 36 __	1. (01=Sys A, 03=Sys C) reservoir quantity low and decreasing. Fluid loss occurred during flap extension or retraction. 2. 29-11-00 Fig. 108 Block 8
29 11 37 00	1. Hydr sys B reservoir quantity low and decreasing. Fluid loss occurred during brake operation. Switching to alternate hydr sys C did not stop fluid loss. 2. 29-11-00 Fig. 108 Block 8

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 38 00	1. Hydr sys B reservoir quantity low and decreasing. Fluid loss occurred during brake operation. Switching to alternate hydr sys C stopped fluid loss. 2. 29-11-00 Fig. 108 Block 8
29 11 39 00	1. Hydr sys C reservoir quantity low and decreasing. Fluid loss occurred during gear retraction or extension. 2. 29-11-00 Fig. 108 Block 8
29 11 40 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir quantity indicates over full. All other indications normal. 2. 29-11-00 Fig. 107 (Sheet 2) Block 3
29 11 41 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) reservoir fluid quantity indication erratic, fluctuating, or intermittent. 2. 29-11-00 Fig. 107 (Sheet 1) Block 2
29 11 42 00	1. Fluid transfer between hydr sys. 2. 29-11-00 Fig. 108 Block 6
29 11 43 __	1. (07=B2, 08=C2) ATM failed to run in AUTO mode with sys press less than 2600 psi. 2. 29-11-00 Fig. 109 (Sheet 2) Block 2
29 11 44 __	1. (07=B2, 08=C2) ATM on/off cycle erratic in AUTO mode. 2. 29-11-00 Fig. 109 Block 2
29 11 45 __	1. (07=B2, 08=C2) ATM stays on in AUTO mode with sys press above 2850 psi. 2. 29-11-00 Fig. 109 (Sheet 2) Block 5

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 46 __	1. (07=B2, 08=C2) ATM fails to run in ON mode.
	2. 29-11-00 Fig. 109 (Sheet 1) Block 2
29 11 47 __	1. (07=B2, 08=C2) ATM overspeed shutdown.
	2. 29-11-00 Fig. 110 Block 4
29 11 48 __	1. (07=B2, 08=C2) rpm low. All other indications normal.
	2. 29-11-00 Fig. 110 Block 1
29 11 49 __	1. (07=B2, 08=C2) ATM rpm indicated zero. All other indications normal.
	2. 29-11-00 Fig. 110 Block 2
29 11 50 __	1. (07=B2, 08=C2) ATM rpm and press slow to buildup.
	2. 29-11-00 Fig. 110 Block 3
29 11 51 __	1. (07=B2, 08=C2) ATM continues to run in OVSP TEST mode.
	2. 29-11-00 Fig. 109 (Sheet 2) Block 12
29 11 52 00	1. AC Pump Hyd sys (B/C) press low (below: 1300 psi sys B - 1700 sys C) when associated PTU and Servos turned on.
	2. 29-11-00 Fig. 114 Block 4
29 11 53 __	1. (02=Sys B, 03=Sys C) Hydr reservoir HI TEM light on during AC pump operation. All other indications normal.
	2. 29-11-00 Fig. 114 Block 9

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 11 54 __	1. (02=Sys B, 03=Sys C) Hydr press low (below 2500) with AC pumps pressurizing system. All other indications normal.
	2. 29-11-00 Fig. 114 Block 4
29 11 55 __	1. (02=Sys B, 03=Sys C) Hydr press low, reservoir fluid level low. All other indications normal.
	2. 29-11-00 Fig. 114 Block 12
29 11 56 __	1. (02=Sys B, 03=Sys C) Hydr press high (above 3200 psi) with AC pumps pressurizing system. All other indications normal.
	2. 29-11-00 Fig. 114 Block 11
29 11 57 __	1. (02=Sys B, 03=Sys C) Hydr press zero with AC PUMP selected and ON indicator on. All other indications normal
	2. 29-11-00 Fig. 115 Block 8
29 11 58 __	1. (05=AC PUMP B3, 06=AC PUMP C3) ON ind off with pump selected, switch in. All other indications normal.
	2. 29-11-00 Fig. 115 Block 5
29 11 59 __	1. (05=AC PUMP B3, 06=AC PUMP C3) ON ind off with pump selected, switch in. System press zero. All other indications normal.
	2. 29-11-00 Fig. 115 Block 5
29 11 60 __	1. (01=Sys A, 02=Sys B, 03=Sys C, 04=Sys D) Abnormal Aft Cabin Vibration with RSVR LO QTY light on.
	2. 29-11-00 Fig. 105 Block 2

FAULT CODE INDEX
TABLE 1

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
29 21 01 00	1. Ram air turbine UNLKD light on, RAT not deployed. Ram air turbine PRESS light and pilots RAT DEPLOYED ann off.
	2. 29-21-00 Fig. 103 Block 6
29 21 02 00	1. Ram air turbine PRESS light came on, RAT not deployed. Ram air turbine UNLKD light and pilots RAT DEPLOYED ann off.
	2. 29-21-00 Fig. 103 Block 8
29 21 03 00	1. Ram air turbine PRESS light not on when RAT deployed. Ram air turbine UNLKD light and pilots RAT DEPLOYED ann on. With sys B engine-driven pump depressurized and B2 ATM switched off, sys press zero with RAT pump only press source.
	2. 29-21-00 Fig. 103 Block 1
29 21 04 00	1. Ram air turbine UNLKD light not on when RAT deployed. Ram air turbine PRESS light and pilots RAT DEPLOYED ann on.
	2. 29-21-00 Fig. 103 Block 19
29 21 05 00	1. Ram air turbine UNLKD and PRESS Lights not on when RAT deployed. Pilots RAT DEPLOYED ann on.
	2. 29-21-00 Fig. 103 Block 10

HYDRAULIC POWER - DESCRIPTION AND OPERATION

1. General

Hydraulic pressure is used to operate flight controls, landing gear, brakes, and nose gear steering (Ref. Fig. 1).

Hydraulic fluid at 3000 psi is supplied to four separate and independent systems by engine-driven pumps. The systems (A, B,
R C, and D) provide multiple coverage for the flight controls and other systems (Ref. Fig. 2 and Fig. 3).

Total hydraulic system volumes, including full reservoirs are as follows:

SYSTEM	VOLUME IN GALLONS (APPROX)
A	27
B	32
C	55
D	23

Secondary or supplemental hydraulic power sources available to the four hydraulic systems are provided by two air turbine motor (ATM) driven hydraulic pumps and two power transfer units (PTU). Bleed air from any engine or from the APU-driven compressor can be directed to either or both ATM-driven hydraulic pumps, one (B2) supporting system B, and the other (C2) supporting system C. The operation of the ATM-driven pumps can be initiated manually or automatically from the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215.

R Two PTU's which transfer hydraulic power mechanically through a motor-pump combination, enable hydraulic power to be transferred from one system to another without transferring hydraulic fluids. One PTU is used between systems B and A, and the other
R is used between C and D. Back-up power systems A and D is supplied by pumps B1 and C1, (by using PTU's) and also secondary power from the ATM and electric motor-driven pumps that support systems B and C. Minimum and maximum engine-driven, ATM, and electric motor-driven pump pressures are as follows:

		ATM AND ENGINE-DRIVEN PUMP PRESSURES (PSI)		ELECTRIC MOTOR-DRIVEN PUMP PRESSURES (PSI) B AND C SYSTEM ONLY (PTU'S NOT IN OPERATION)	
		Minimum	Maximum	Minimum	Maximum
CR CR CR	Servos On (Not Actuated)	2850	3150	2500	3150
CR	Servos Off	2850	3150	2850	3150

NOTE: Due to limited flow capability of the AC Pumps and relatively high acceptable internal leakage of the hydraulic systems, it is possible for both B and A or C and D system pressures to appear low if only the respective AC pump and PTU are used to pressurize the two hydraulic systems. For established system minimum pressure limits, refer 29-11-00, 201. If in doubt, perform pressure check in 29-11-00, Page 601.

A ram air turbine (RAT) provides auxiliary hydraulic power in case of an all engines out emergency. It is deployed into the fuselage centerline airstream from a stowed position below the wing box beam forward of the hydraulic service center. Adequate pressure and flow for the flight controls is provided at altitude and during approach and landing speeds. The RAT pump pressurizes system B (Ref. 29-21-00).

2. Hydraulic Power Distribution

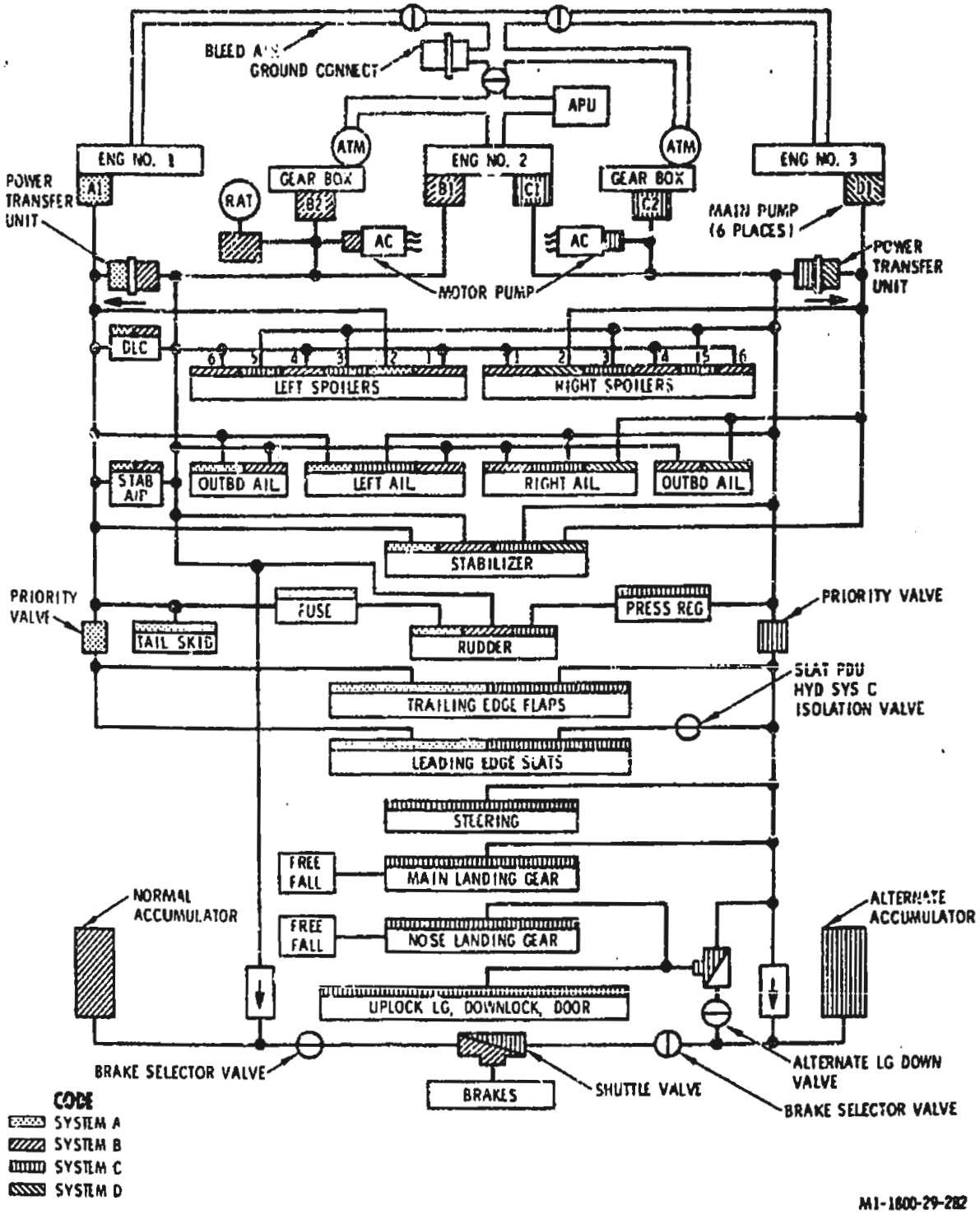
A. Description

Hydraulic power from the main and supplemental power sources is distributed to the flight control and utility systems to obtain the maximum dispatch reliability (Ref. Fig. 4).

The horizontal stabilizer uses four actuators, each powered by one of the four hydraulic systems (A, B, C, and D), for maximum reliability.

The rudder uses two dual-tandem actuators which are powered by systems A, B, and C.

The left and right ailerons are divided into inboard and outboard sections, each powered by two or three systems as follows:

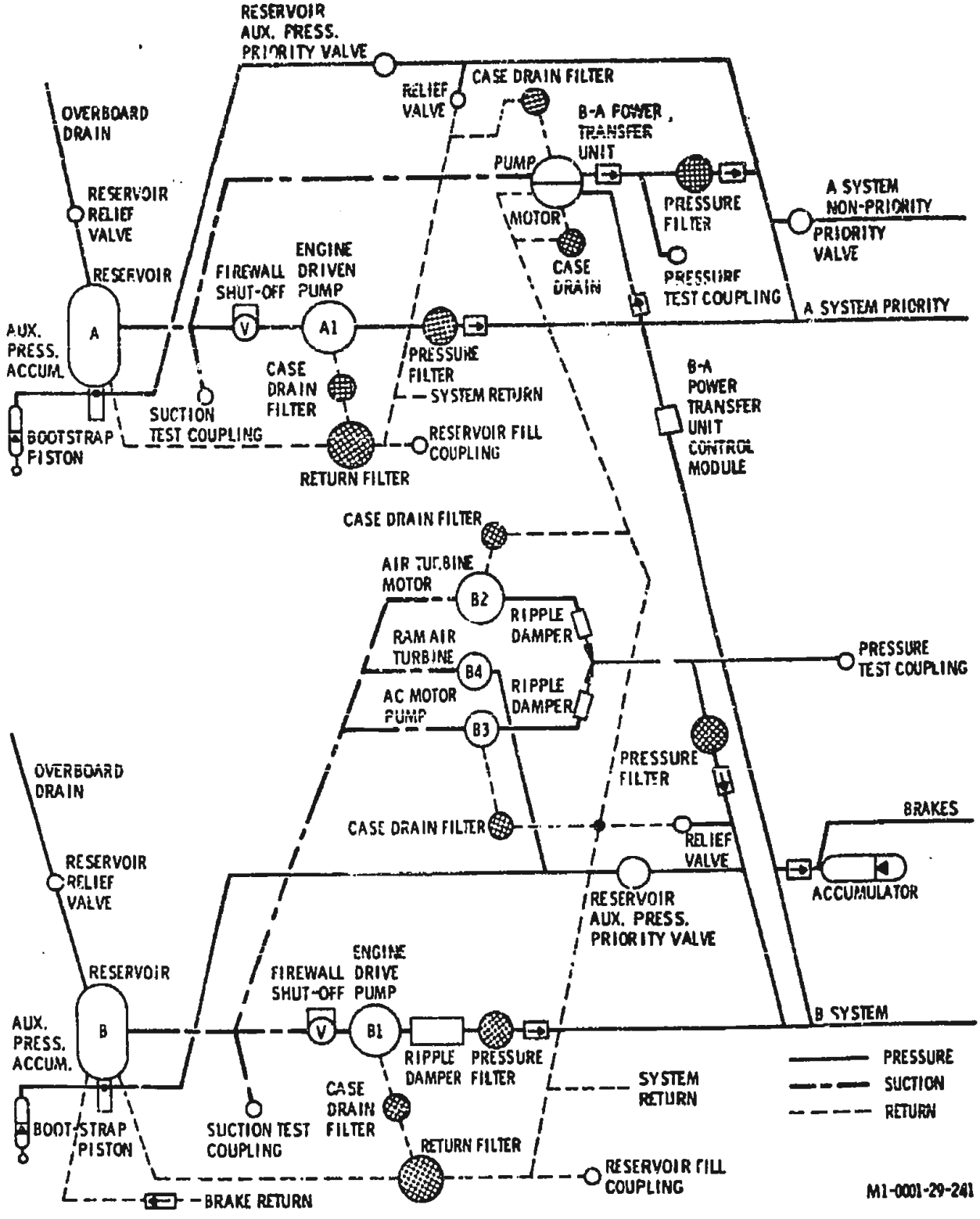


R
R

Hydraulic System Block Diagram
Figure 1

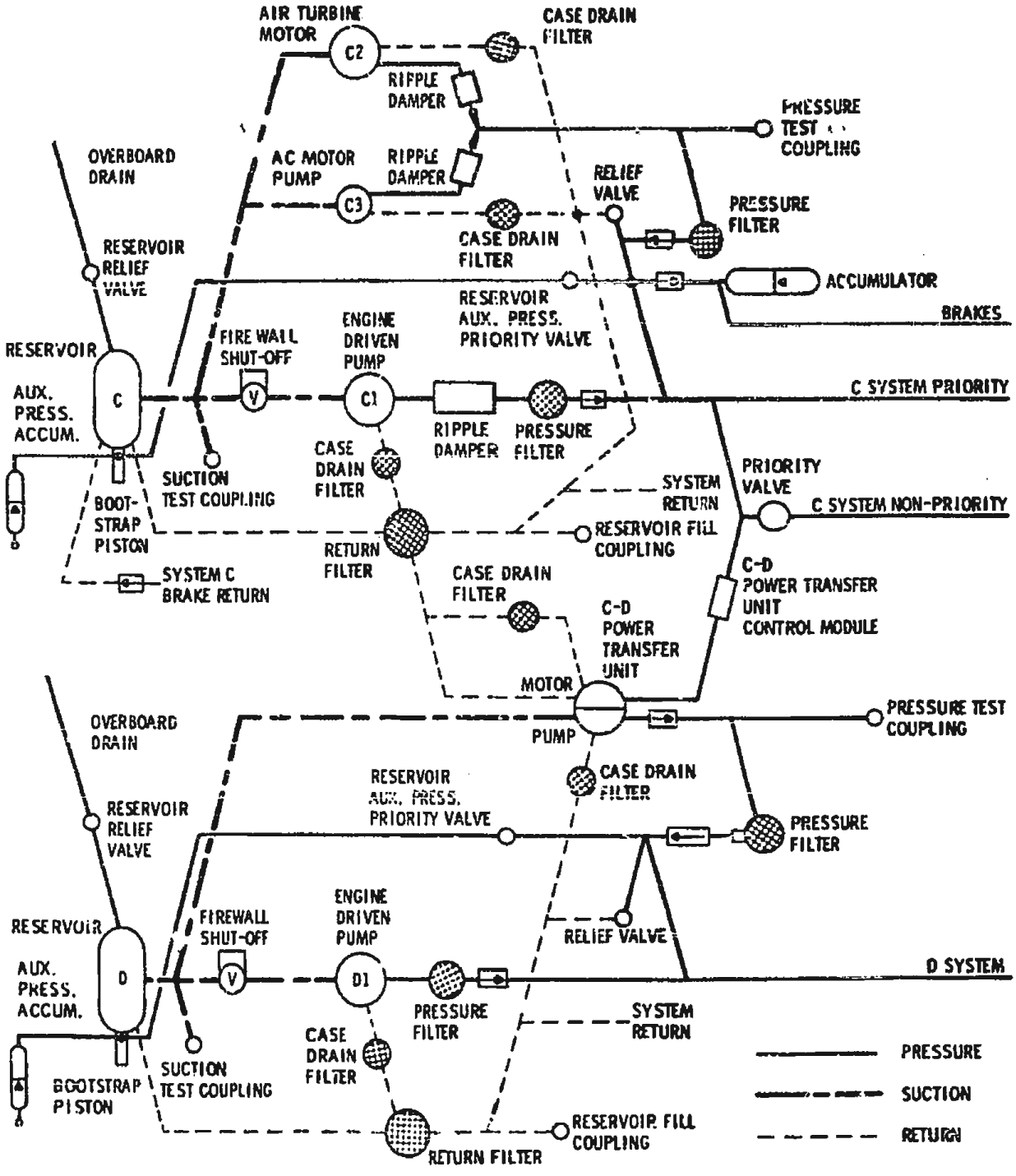
EFFECTIVITY: ALL

001B



R Hydraulic Power Functional Schematic, Systems A and B
R Figure 2

EFFECTIVITY: ALL



M1-0001-29-242

R Hydraulic Power Functional Schematic, Systems C and D
R Figure 3

EFFECTIVITY: ALL

001B

CONTROL SURFACE/SUBSYSTEM	CHAPTER REF.	HYDRAULIC SYSTEM A	B	C	D
PRIMARY FLIGHT CONTROLS					
STABILIZER	27-41-00	X	X	X	X
RUDDER	27-21-00	X	X	X	
AILERON, INBOARD - LH	27-11-00	X	X	X	
AILERON, INBOARD - RH	27-11-00		X	X	X
AILERON, OUTBOARD - LH	27-11-00	X	X		
AILERON, OUTBOARD - RH	27-11-00		X		X
SPOILER PANELS (NUMBERED INBD - OUTBD)					
PANELS 3, 5 (LH AND RH)	27-61-00			X	
PANELS 1, 4, 6 (LH AND RH)	27-61-00		X		
PANEL 2 (LH)	27-61-00	X			
PANEL 2 (RH)	27-61-00				X
DIRECT LIFT CONTROL	22-03-00	X	X		
AUTOPILOT	22-01-00	X	X		
SECONDARY FLIGHT CONTROLS/LANDING GEAR/BRAKES					
LEADING EDGE SLATS	27-81-00	*		*	
TRAILING EDGE FLAPS	27-51-00	*		*	
MAIN LANDING GEAR	32-31-00			*	
NOSE LANDING GEAR	32-20-00			*	
NOSE GEAR STEERING	32-51-00			*	
BRAKES - NORMAL	32-43-00		X		
BRAKES - ALTERNATE	32-44-00			*	
TAIL SKID	32-71-00	X			
PARKING BRAKES	32-48-00		X		

HYDRAULIC POWER SOURCE/SYSTEM ASSIGNMENT					
TYPE OF HYDRAULIC PUMP		(PUMP DESIGNATION)			
ENGINE DRIVEN	29-11-00	(A-1)	(B-1)	(C-1)	(D-1)
AIR TURBINE MOTOR DRIVEN (ATM)	29-11-00		(B-2)	(C-2)	
ELECTRIC MOTOR DRIVEN	29-11-00		(B-3)	(C-3)	
HYDRAULIC MOTOR DRIVEN (PTU)	29-11-00	(B-A)			(C-D)
RAM AIR TURBINE SYSTEM (RAT)	29-21-00		(B-4)		

* SYSTEMS DOWNSTREAM OF PRIORITY VALVES

HA 0124
M1-0101-29-033

Hydraulic System and Power Source Distribution
Figure 4

The LH inboard section is powered by systems A, B, and C.

The LH outboard section is powered by systems A and B.

The RH inboard section is powered by systems B, C, and D.

The RH outboard section is powered by systems B and D.

The wing spoiler panels (six for each wing) are numbered 1 to 6 inboard-to-outboard. Each spoiler panel is powered by one hydraulic system. The system-to-spoiler assignments are as follows:

System A: LH spoiler panel No. 2

System B: LH and RH spoiler panels No. 1, 4, and 6

System C: LH and RH spoiler panels No. 3 and 5

System D: RH spoiler panel No. 2

Secondary flight controls, trailing edge flaps and leading edge slats, are powered by systems A and C. Each system is capable of supplying the required force for normal system operation in the event of one system failure.

The main landing gear and nose landing gear extension and retraction, and nose gear steering are powered from system C.

The brake systems, normal and alternate, are powered by system B and C, respectively. Pressure from the alternate brake system accumulator can also be directed to the landing gear uplock and door release system to assist during emergency gear extension. The hydraulic power system and component operation is shown on the hydraulic power system schematic (Ref. Fig. 5).

3. Hydraulic System Control Panels

A. Description

Each of the four hydraulic systems can be monitored and controlled from the Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215 (Ref. Fig. 6). Control switchlights permit any engine-driven pump to be depressurized and a secondary or supplemental power source (ATM or PTU) to be directed to any particular system. Manual deployment of the RAT is also controlled from this

panel. Indicators are provided to monitor hydraulic system pressure, reservoir fluid quantity, and system malfunctions.

The hydraulic power system can be operated on the ground from the controls on the HYDRAULIC SERVICE PANEL in the hydraulic service center, zone 147, (Ref. Fig. 7). The controls in the service center operate the electric motor-driven pumps and PTU pumps for a source of hydraulic pressure. System and reservoir pressure gages, fluid quantity and temperature indicators, and clogged filter warning lights provide the necessary controls and indications for system maintenance and fault isolation functions.

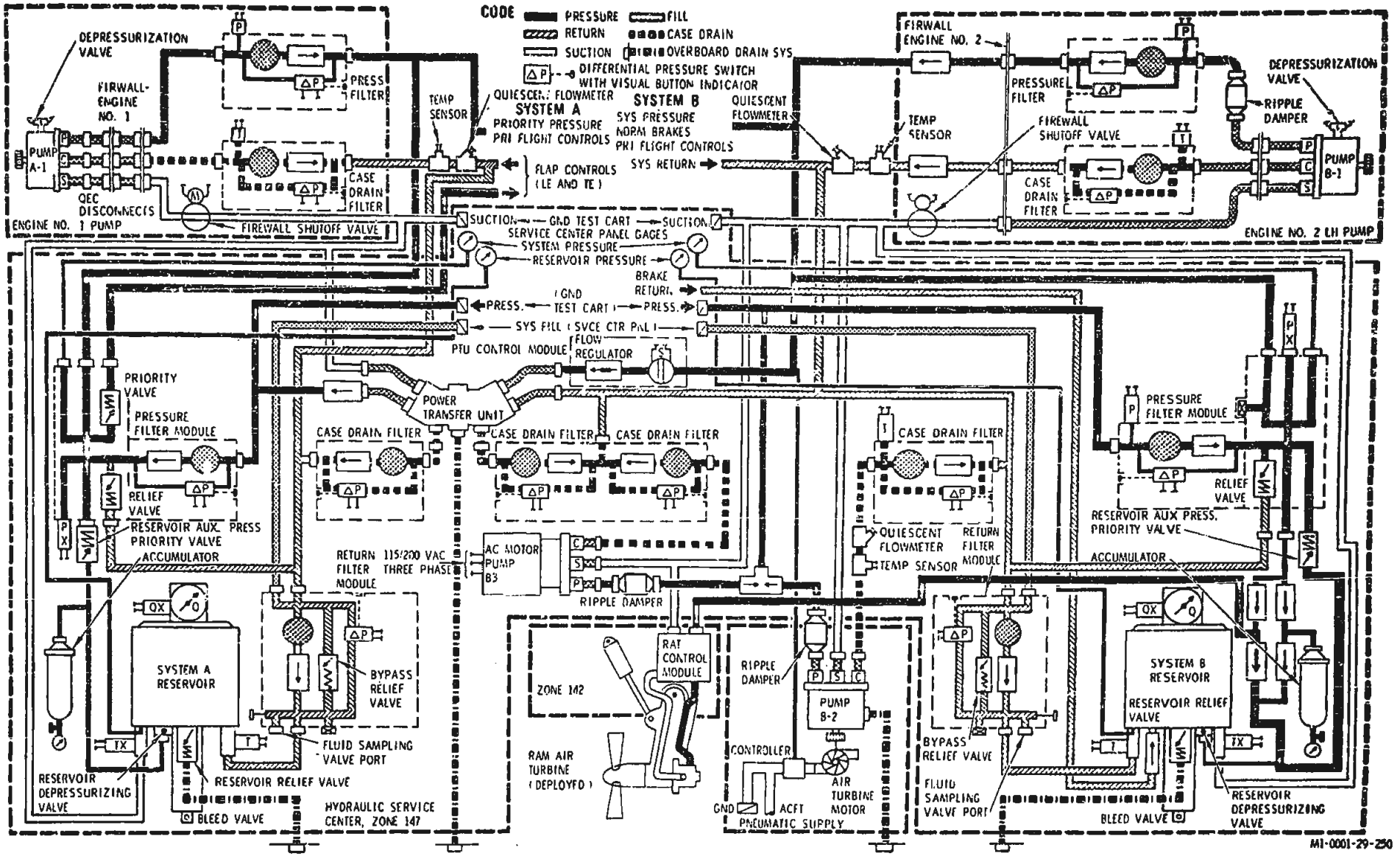
4. Hydraulic Service Center

A. Description

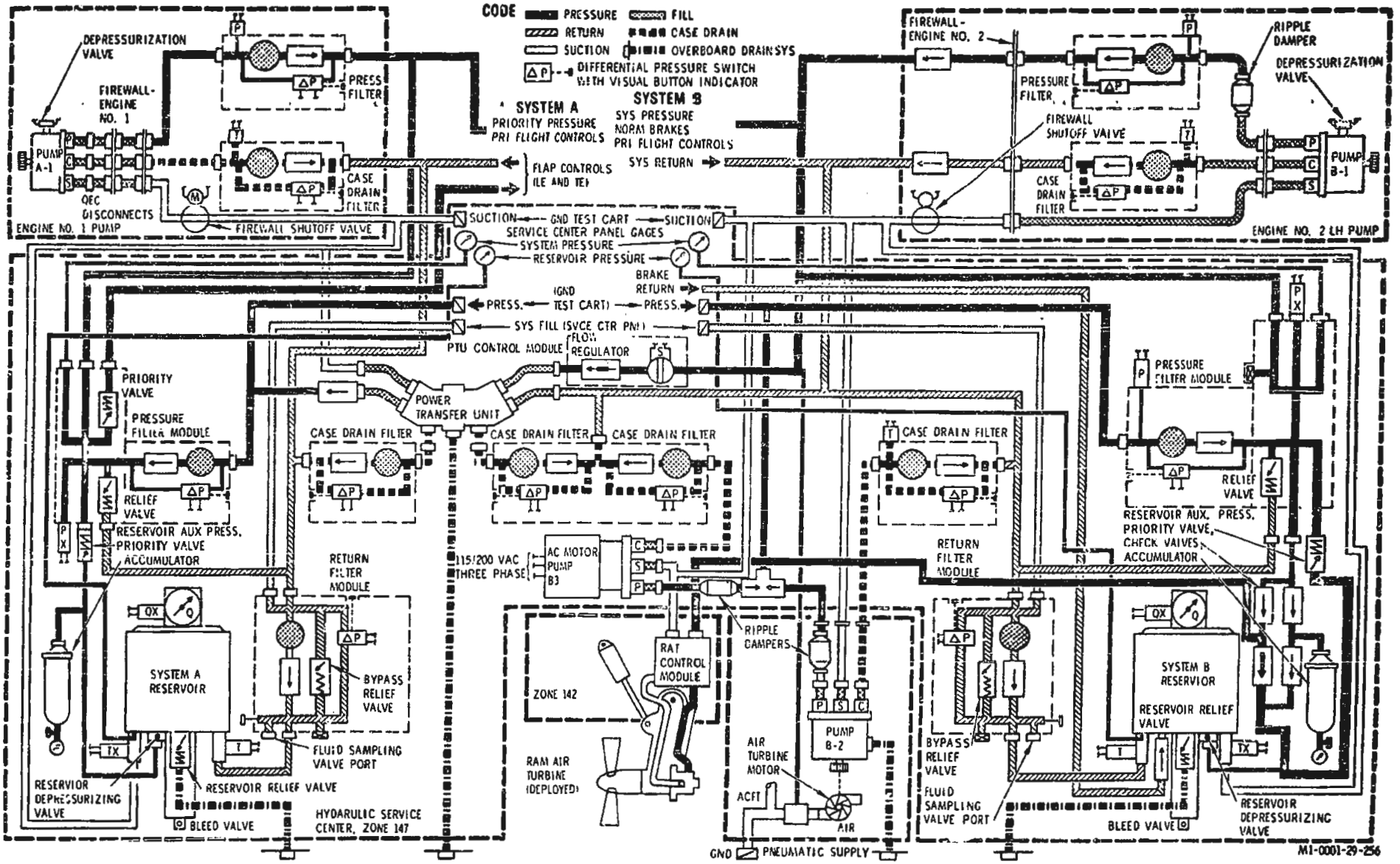
The hydraulic service center, located aft of the wing rear beam and between the main landing gear wheel well cavities, contains the major hydraulic power system components with the exception of the ATM units, which are located in the wheel well fuselage fairing area, zones 195 and 196 (Ref. Fig. 8).

The compartment is not pressurized and is not accessible during flight. Ground access into the hydraulic service center is possible through either of two doors, 147AB and 147BB, at the forward and aft ends of the compartment. The forward door contains louvers to provide ventilation of the compartment.

Hydraulic pressure for system checkout during ground maintenance is available from the ATM-driven hydraulic pumps powered from either the APU-driven compressor or from a ground air source. Low-flow hydraulic pressure is provided by two electric motor-driven hydraulic pumps to supply component or system pressure for checkout and for charging the brake accumulators during ground operations. Ground service connections, (pressure and return quick disconnects) are located in the hydraulic service center for each of the four systems. A ground service hydraulic power unit can supply hydraulic power to any system when the on-board power systems are inoperative.



R Hydraulic Power System Schematic
R Figure 5 (Sheet 1)

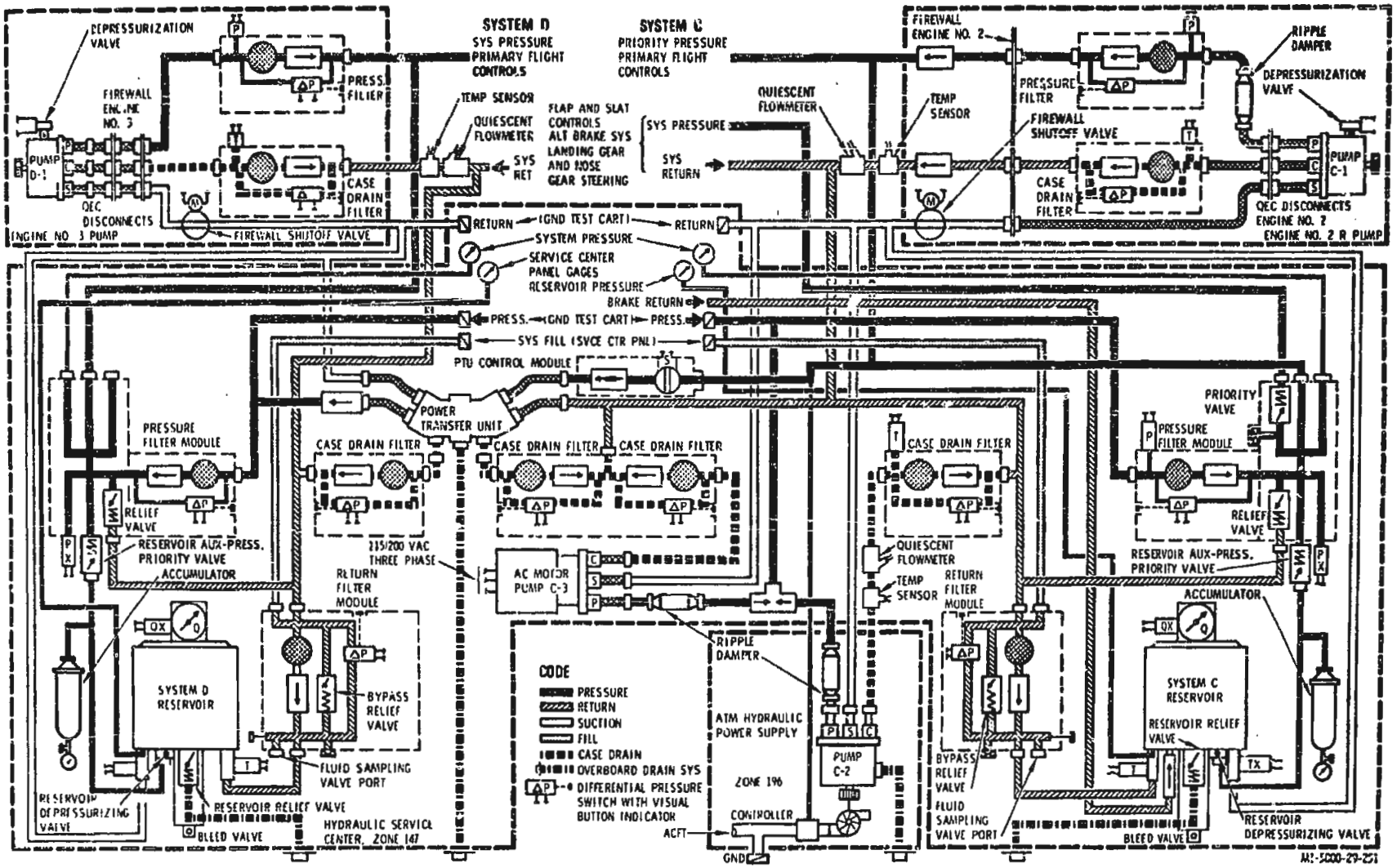


R
R

Hydraulic Power System Schematic
Figure 5 (Sheet 1)

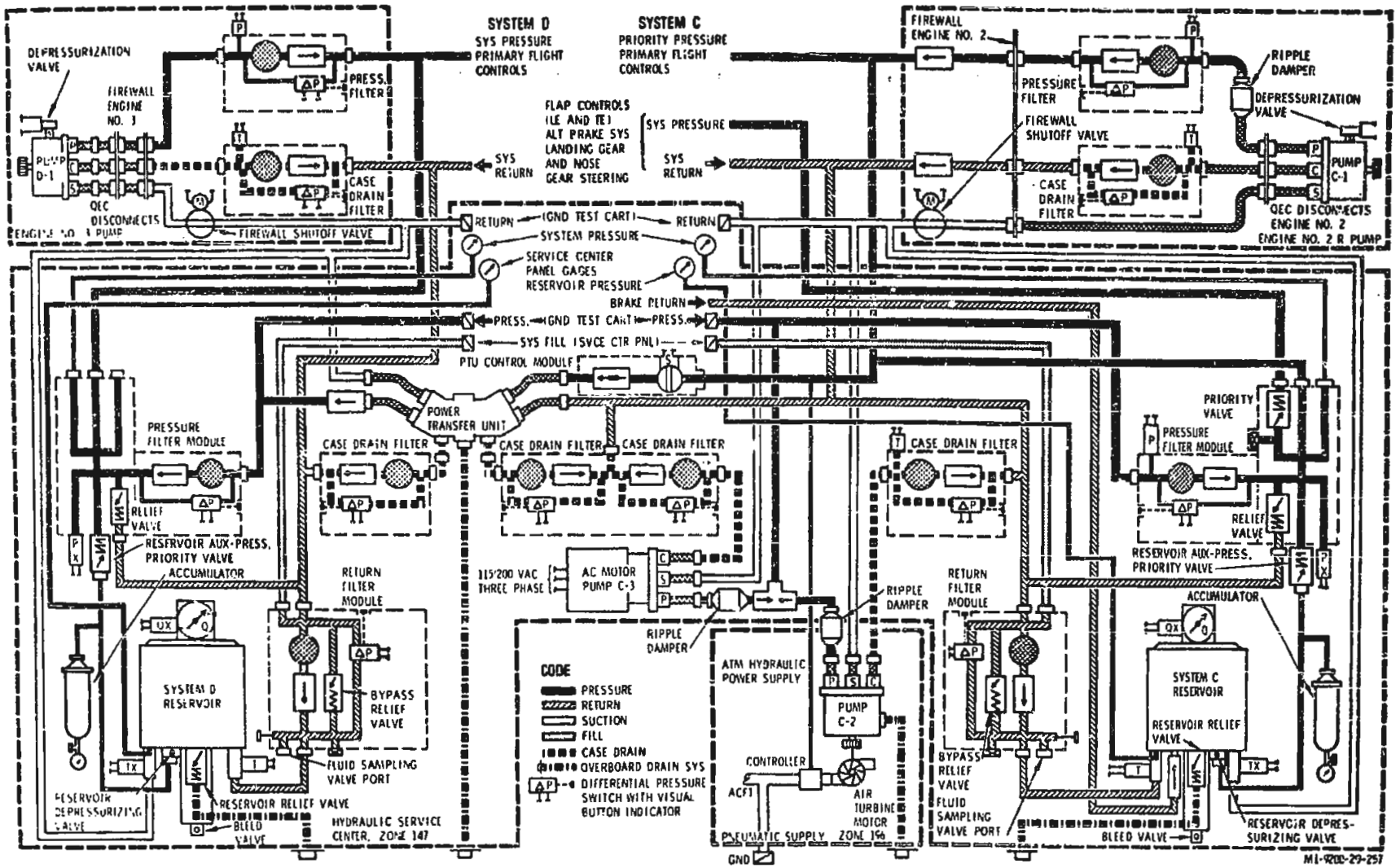
EFFECTIVITY: 032-999

001B



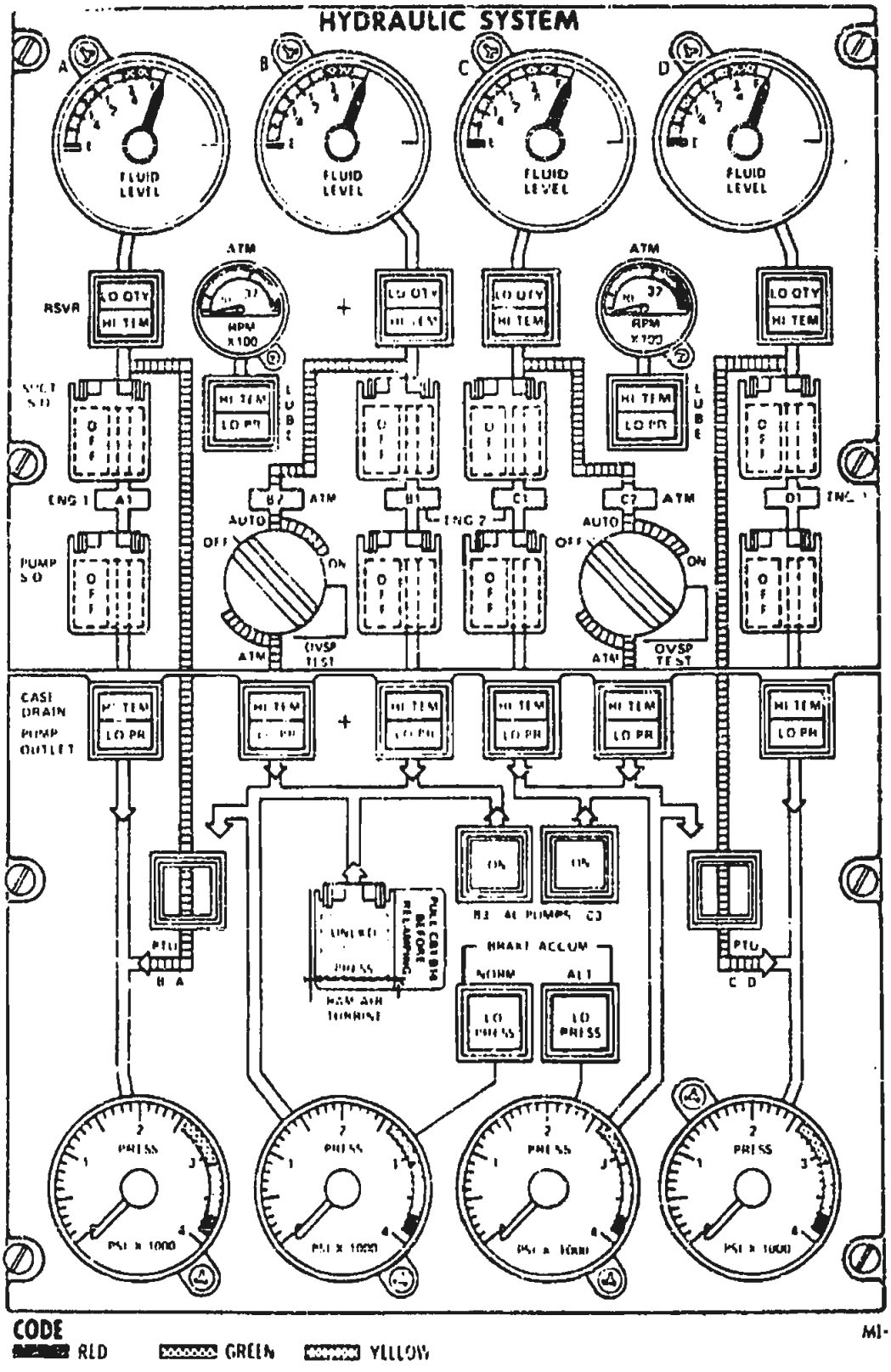
Hydraulic Power System Schematic
Figure 5 (Sheet 2)

R EFFECTIVITY: 001-031
R
001B

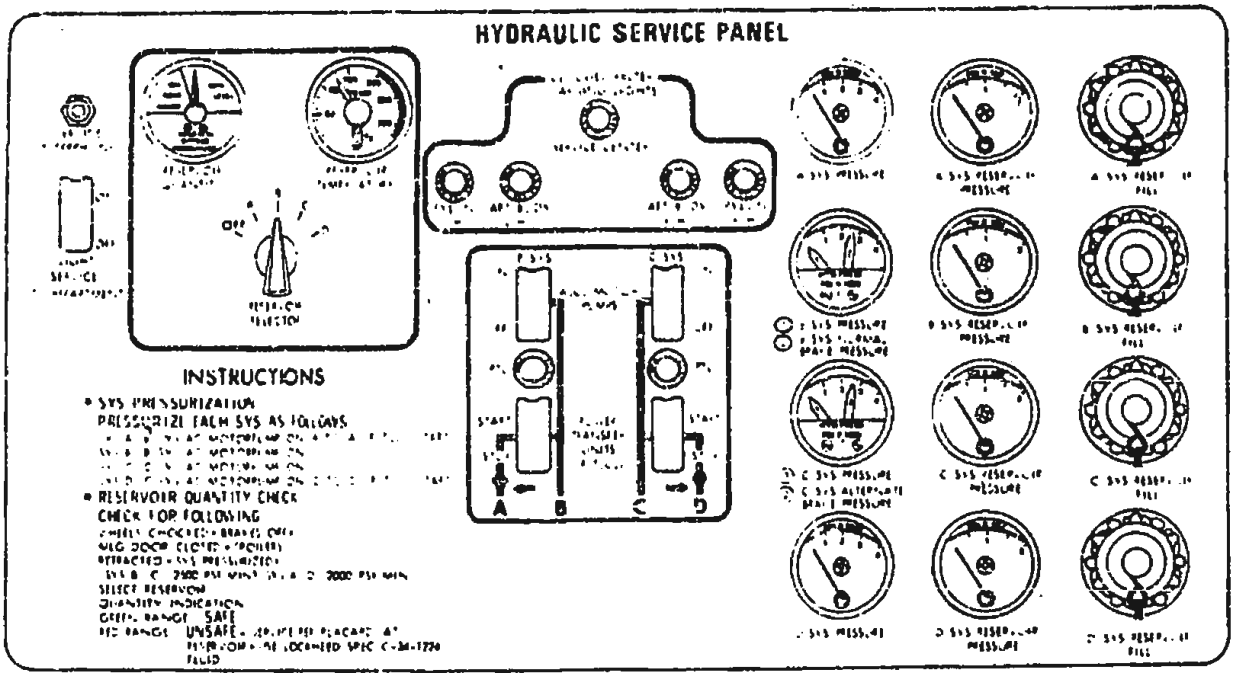


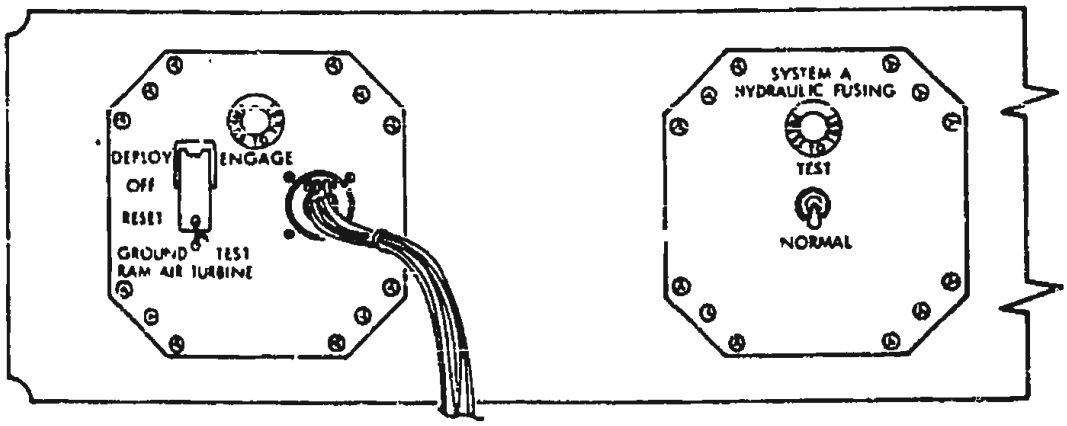
Hydraulic Power System Schematic
Figure 5 (Sheet 2)

R EFFECTIVITY: 032-999
R
001B



Hydraulic System Control Panel
Figure 6





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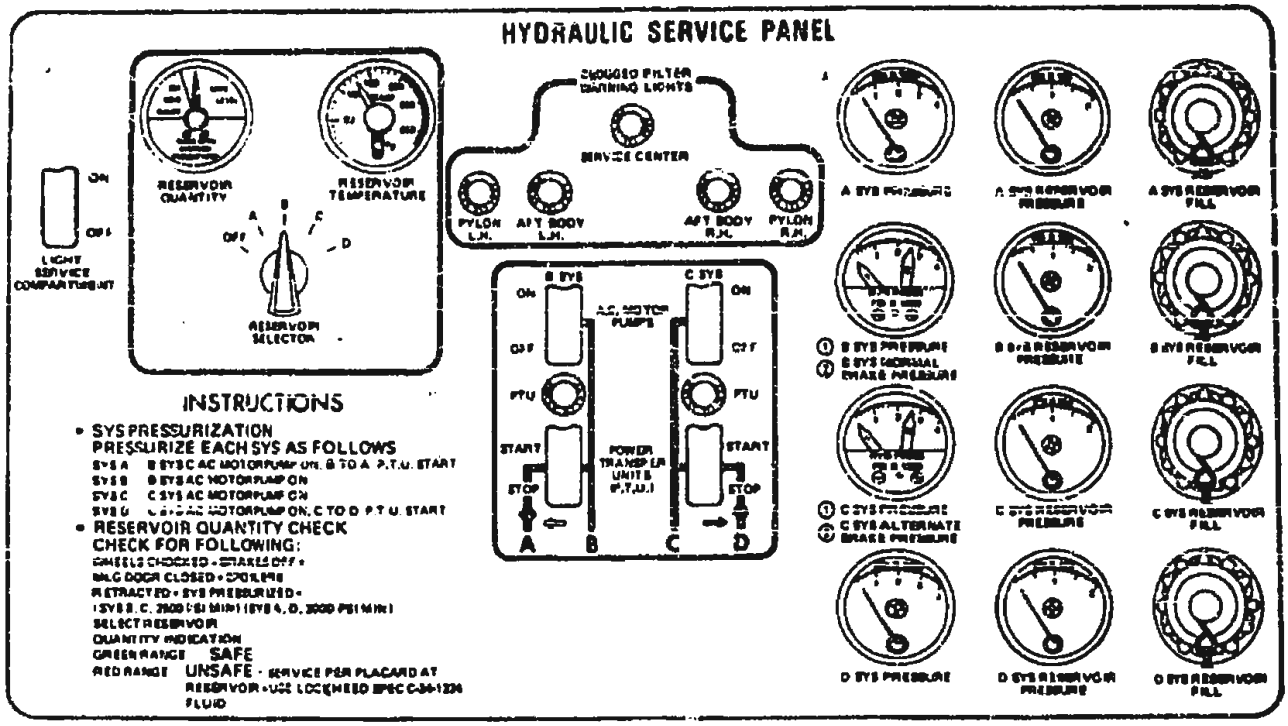
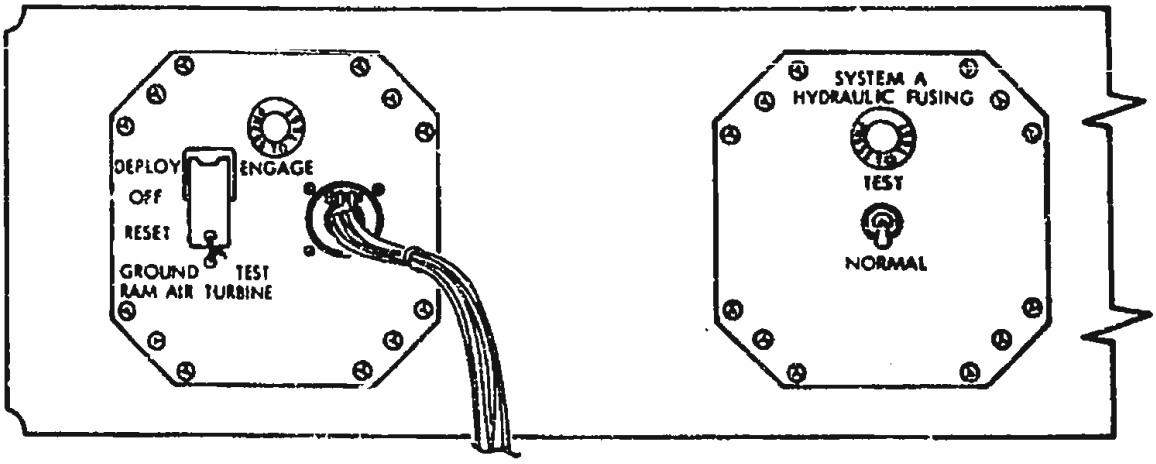
R Hydraulic Service Panel
R Figure 7





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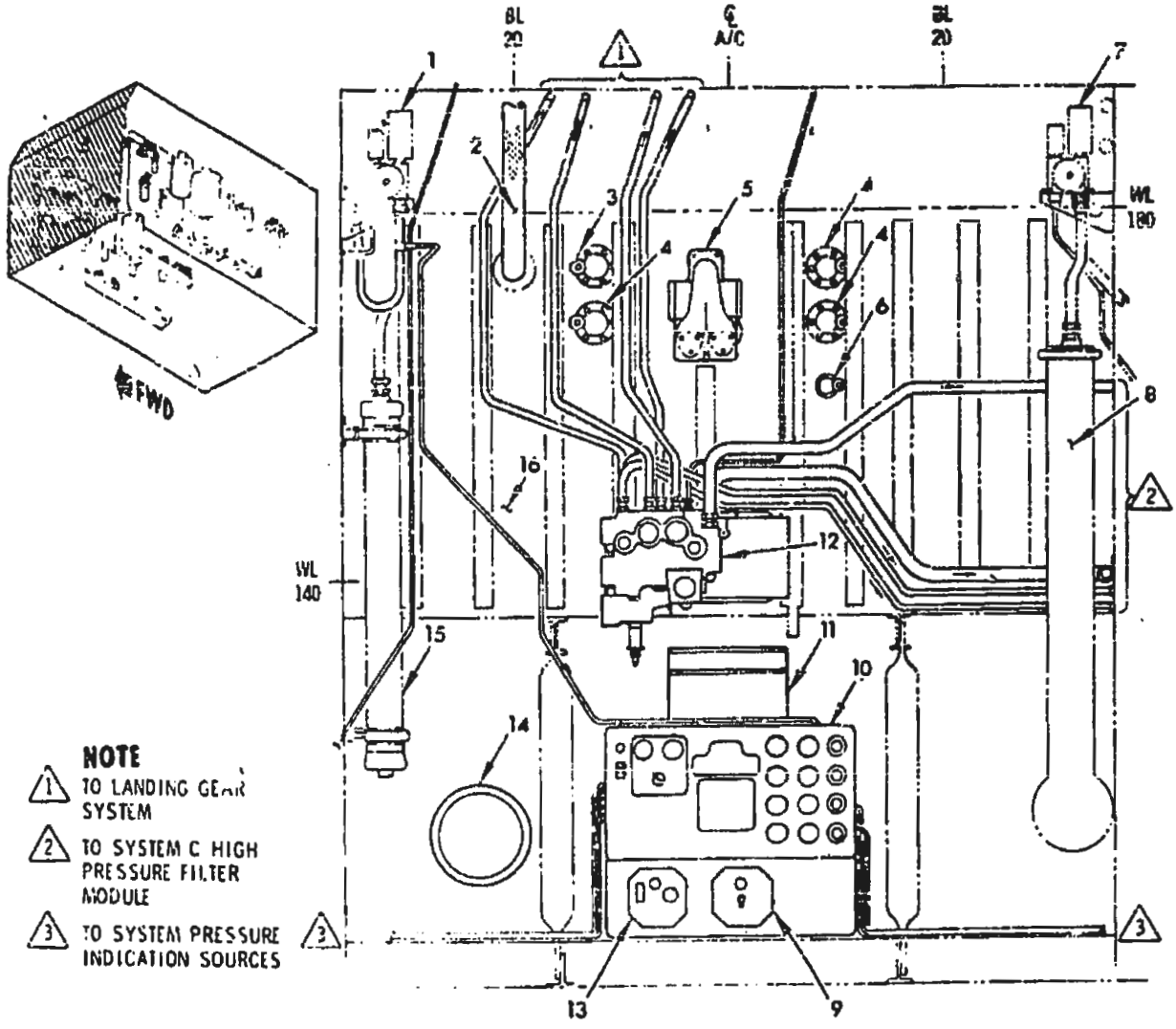
Hydraulic Service Panel
Figure 7



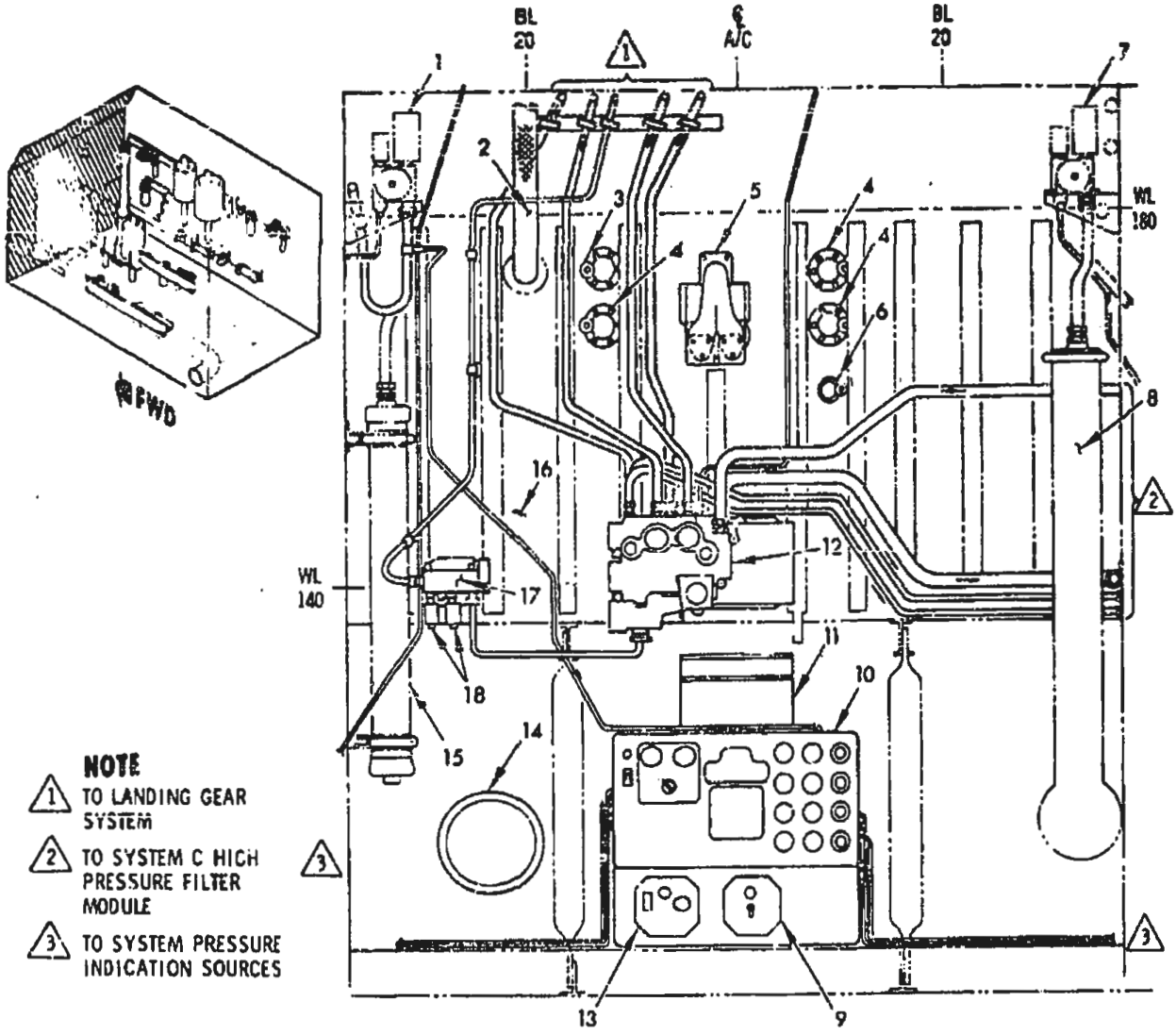
VIEW LOOKING FORWARD

LEGEND

1 NORMAL BRAKE SYSTEM SUPPLY VALVE
2 FUEL LINE TO NO. 2 ENGINE
3 ENG NO 2 TANK VALVE
4 FUEL CROSSFEED VALVE
5 FUEL FLOW EQUALIZER
6 FUELING MANIFOLD ISOLATION VALVE
7 ALTERNATE BRAKE SYSTEM SUPPLY VALVE
8 ALTERNATE BRAKE SYSTEM ACCUMULATOR
9 SYSTEM A HYDRAULIC FUSING PANEL
10 HYDRAULIC SERVICE PANEL
11 RAM AIR TURBINE SUPPORT STRUCTURE
12 LANDING GEAR CONTROL MODULE
13 RAM AIR TURBINE GROUND TEST PANEL
14 BLEED AIR SUPPLY DUCT
15 NORMAL BRAKE SYSTEM ACCUMULATOR
16 WING BOX BEAM AFT BULKHEAD

M1-0102-29-141

Hydraulic Service Center Component Locator
Figure 8 (Sheet 1)



VIEW LOOKING FORWARD

LEGEND

1 NORMAL BRAKE SYSTEM SUPPLY VALVE
2 FUEL LINE TO NO. 2 ENGINE
3 ENG NO. 2 TANK VALVE
4 FUEL CROSSFEED VALVE
5 FUEL FLOW EQUALIZER
6 FUELING MANIFOLD ISOLATION VALVE
7 ALTERNATE BRAKE SYSTEM SUPPLY VALVE
8 ALTERNATE BRAKE SYSTEM ACCUMULATOR
9 SYSTEM A HYDRAULIC FUSING PANEL
10 HYDRAULIC SERVICE PANEL
11 RAM AIR TURBINE SUPPORT STRUCTURE
12 LANDING GEAR CONTROL MODULE
13 RAM AIR TURBINE GROUND TEST PANEL
14 BLEED AIR SUPPLY DUCT
15 NORMAL BRAKE SYSTEM ACCUMULATOR
16 WING BOX BEAM AFT BULKHEAD
17 FUSE MODULE ASSEMBLY
18 PRESSURE SWITCH, AUTO-GROUND SPOILER

M1-0100-29-383

Hydraulic Service Center Component Locator
Figure 8 (Sheet 1)

5. Hydraulic System Fluid

A. Description

The fluid used in the hydraulic system is a fire-resistant, phosphate-ester fluid capable of preforming in a wide range of temperature conditions. The fluids used should comply with Lockheed Specification C-34-1224C, Type II or III, or Type IV
C Type IV (Ref. Table 1). The fluids, which are similar to
C fire-resistant fluids now in use, are compatible and mixable in
C any percentage of mixture. The hydraulic components and seals
C in the system must be made of ethylene propylene rubber material
C or Teflon. Components made of Buna-N rubber soften and swell in
C phosphate-ester base synthetic fluids. Type II fluids have an
C operating temperature range of -65 to +225°F; Type III and IV
C have an operating range of -65° to +250°F. All fluid types are
C dyed purple or blue. All fluids have a pour point below -80°F.

C B. Fluid Miscibility and Compability

C (1) All hydraulic fluid stocked under TWA stk. No. 50-1198
C will comply with Lockheed Specification C34-1224,
C Boeing Material Specification BMS 3-11 and Douglas
C Material Specification DMS 2014 Type IV fluids.

C Following listed fluids are qualified and approved to
C the specifications noted above:

C Chevron HYJET IV

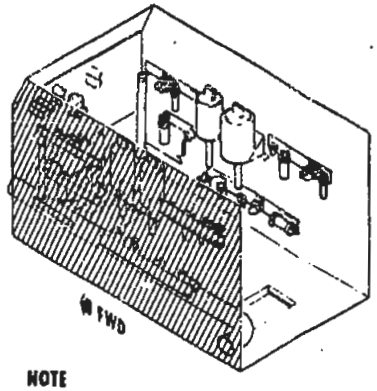
C Monsanto Skydrol 500B - IV and LD - IV.

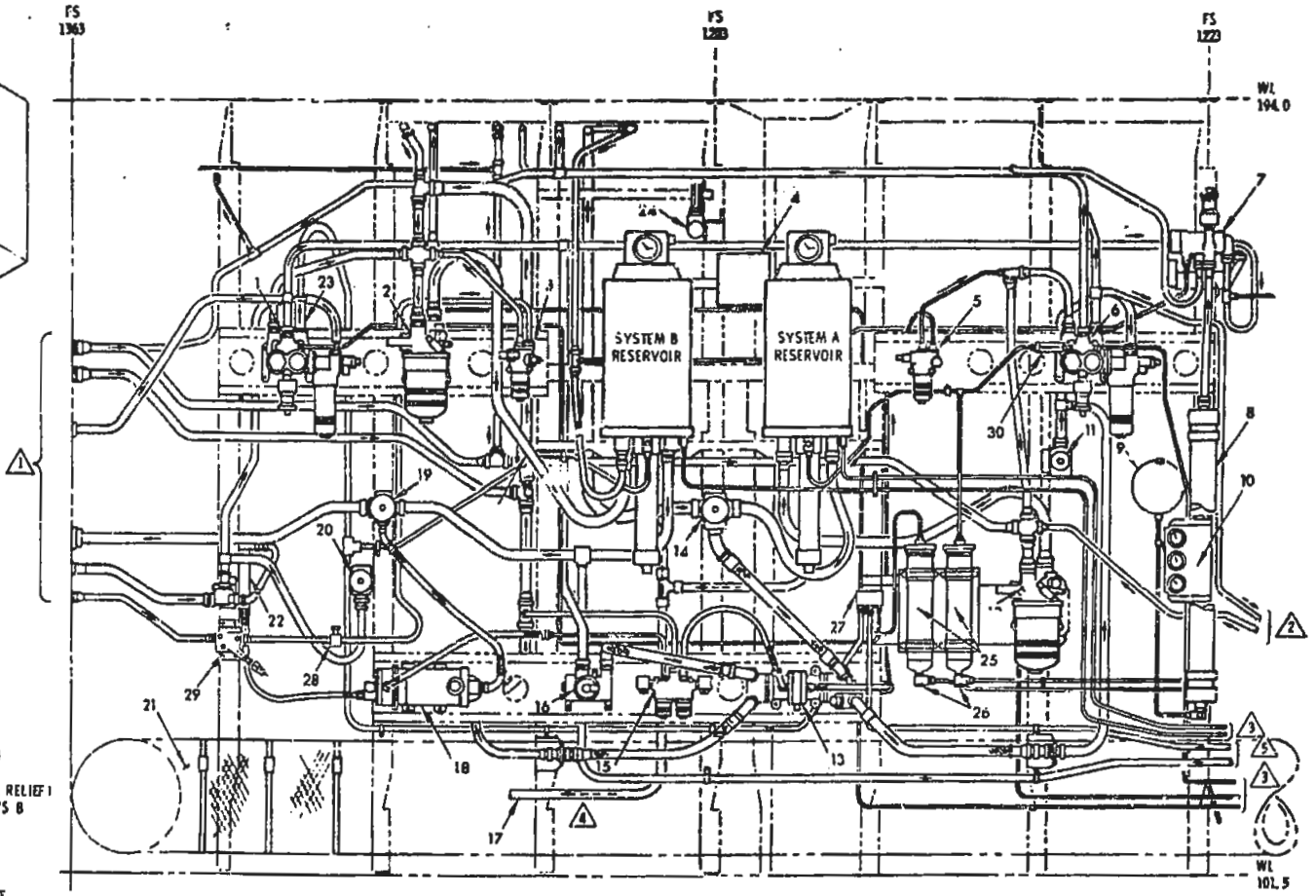
C All of these fluids are completely miscrible and
C compatible in any percentage of mixture. Such mixtures
C will not adversely affect hydraulic system operational
C performance.

C C. O-Ring Seal and Gasket Fluid Lubrication

C (1) A lubricant, No. MCS-352 or Hi-Lo MS N. 1, shall be
C used on "O" rings installed on unions, plugs or other
C fittings in a system with fire resistant fluid where
C twisting or cutting of "O" ring can occur during
C installation.

C CAUTION: THIS LUBRICANT SHALL NOT BE USED ON ANY
C APPLICATION USING MIL-H-5606 (RED) HYDRAULIC OIL.



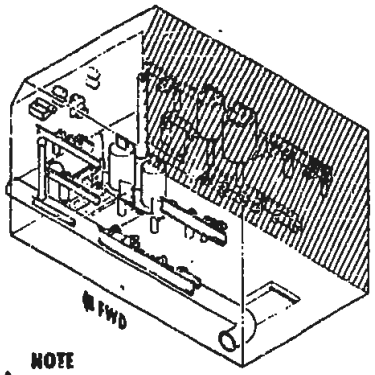


NOTE

1. TO AFT FUSELAGE HYDRAULIC UNITS
2. TO SYSTEM A HYDRAULIC UNITS
3. TO HYDRAULIC SERVICE PANEL
4. ---- OVERBOARD DRAIN SYSTEM
5. TO RAM AIR TURBINE

1 HIGH PRESSURE FILTER MODULE, SYS B
2 RETURN FILTER MODULE, SYS B
3 CASE DRAIN FILTER, ATM PUMP, SYS B
4 RESERVOIR SERVICE INSTRUCTIONS PLACARD
5 CASE DRAIN FILTER, PTU PUMP
6 HIGH PRESSURE FILTER MODULE, SYS A
7 NORMAL BRAKE SUPPLY VALVE
8 NORMAL BRAKE SYSTEM ACCUMULATOR
9 RESERVOIR, AIR STOWAGE, SYS B
10 ACCUMULATOR PRESSURE GAGES
11 GROUND SERVICE FITTING, SYS A PRESSURE
12 RETURN FILTER MODULE, SYS A
13 POWER TRANSFER UNIT (PTU) SYS B TO A
14 GROUND SERVICE FITTING, SYS A RETURN
15 DUAL CASE DRAIN FILTER, ELEC PUMP AND PTU
16 POWER TRANSFER UNIT (PTU) CONTROL MODULE
17 OVERBOARD DRAIN LINE (RESERVOIR PRESSURE RELIEF)
18 ELECTRIC MOTOR-DRIVEN HYDRAULIC PUMP, SYS B
19 GROUND SERVICE FITTING, SYS B RETURN
20 GROUND SERVICE FITTING, SYS B PRESSURE
21 BLEED AIR SUPPLY DUCT
22 AC PUMP RIPPLE DAMPER
23 SYS B RESERVOIR AUX. PRESS. PRIORITY VALVE
24 MLG MANUAL DOOR CONTROL VALVE
25 SYS A, B RESERVOIR AUX. PRESS. ACCUMULATORS
26 ACCUMULATOR CHARGING VALVES
27 SYS B RESERVOIR AUX. PRESS. CHECK VALVE MODULE
28 TEMPERATURE SENSOR
29 QUILSCENT FLOWMETER
30 SYS A RESERVOIR AUX. PRESS. PRIORITY VALVE

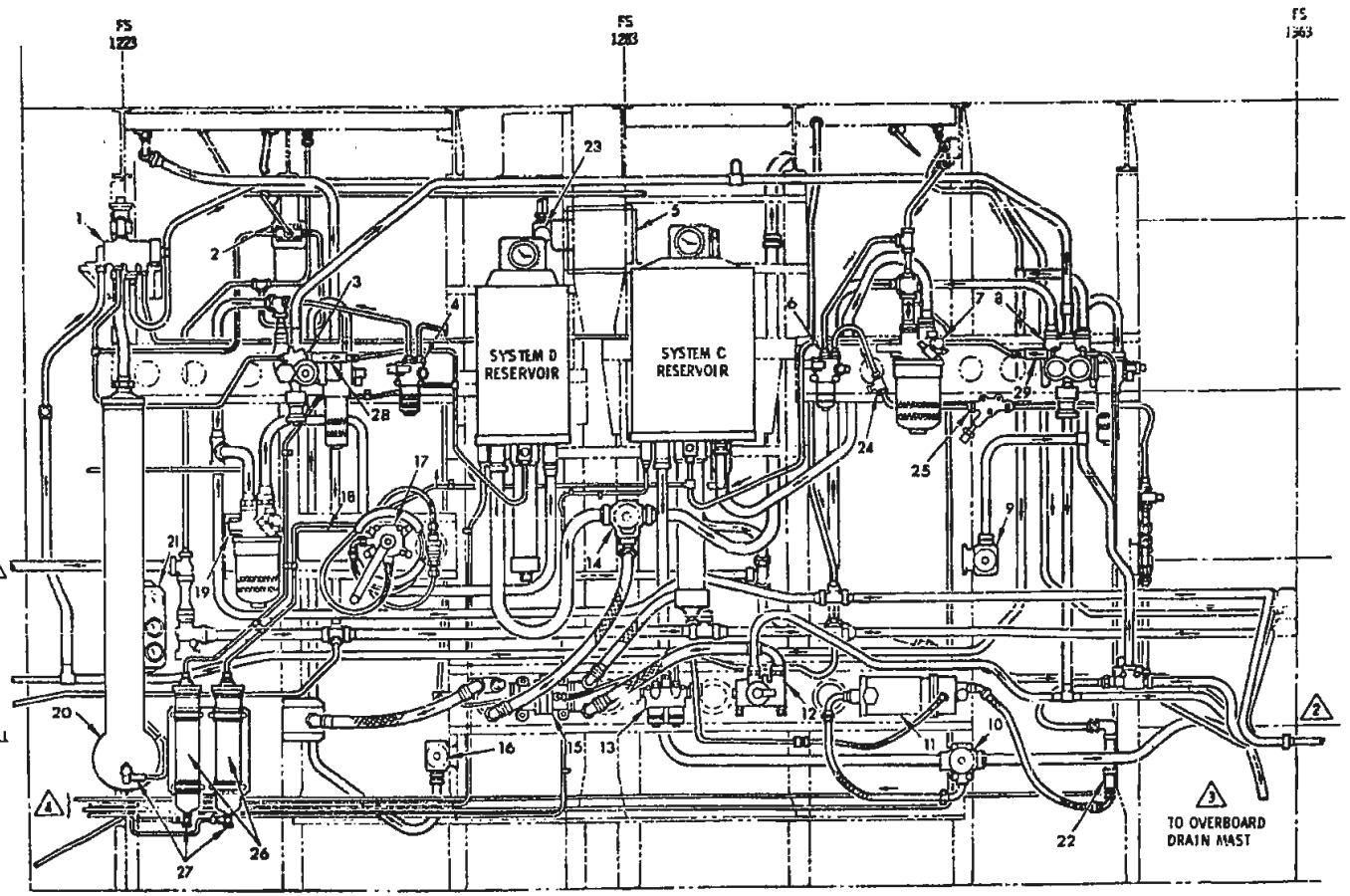
Hydraulic Service Center Component Locator
Figure 8 (Sheet 2)



NOTE

1. SYSTEM C RETURN (LANDING GEAR)
2. TO AFT FUSELAGE HYDRAULIC UNITS
3. ---- OVERBOARD DRAIN SYSTEM
4. TO HYDRAULIC SERVICE PANEL

1 ALTERNATE BRAKE SUPPLY VALVE
2 ALTERNATE HYD L.G. EXTENSION VALVE
3 HIGH PRESSURE FILTER MODULE, SYS D
4 CASE DRAIN FILTER, PTU PUMP
5 RESERVOIR SERVICE INSTRUCTIONS PLACARD
6 CASE DRAIN FILTER, ATM PUMP, SYS C
7 RETURN FILTER MODULE, SYS C
8 HIGH PRESSURE FILTER MODULE, SYS C
9 GROUND SERVICE FITTING, SYS C PRESSURE
10 GROUND SERVICE FITTING, SYS C RETURN
11 ELECTRIC MOTOR-DRIVEN HYDRAULIC PUMP, SYS C
12 POWER TRANSFER UNIT (PTU) CONTROL MODULE
13 DUAL CASE DRAIN FILTER, ELECTRIC PUMP AND PTU
14 GROUND SERVICE FITTING, SYS D RETURN
15 POWER TRANSFER UNIT (PTU), SYS C TO D
16 GROUND SERVICE FITTING, SYS D PRESSURE
17 HAND PUMP, RESERVOIR FILL
18 HAND PUMP INSTRUCTION PLACARD, RESERVOIR FILL
19 RETURN FILTER MODULE, SYS D
20 ALTERNATE BRAKE SYSTEM ACCUMULATOR
21 ACCUMULATOR PRESSURE GAGES
22 AC PUMP RIPPLE DAMPER
23 MLG MANUAL DOOR CONTROL VALVE
24 ATM CASE DRAIN TEMPERATURE SENSOR
25 ATM CASE DRAIN QUIESCENT FLOW METER
26 RESERVOIR AUX. PRESS. ACCUMULATORS (2)
27 ACCUMULATOR CHARGING VALVES (3)
28 SYS D RESERVOIR AUX. PRESS PRIORITY VALVE
29 SYS C RESERVOIR AUX. PRESS PRIORITY VALVE



Hydraulic Service Center Component Locator
Figure 8 (Sheet 3)

R New Hydraulic Fluid Physical Properties, LAC C-34-1224C
Table 1

FLUID PROPERTY	UNIT	VALUE
Viscosity	CS at 100 degrees F	9.0 to 12.5
Low temperature pour point	degrees F	-80
R Density (spec gravity)	g/cc at 25 degrees	0.989 to 1.060 (Type II and Type IV Class 2)
R		0.989 to 1.010 (Type III and Type IV Class 1)
Neutralization No.	mg KOH/g	0.20 max
Moisture content	% by weight	0.40 to 0.60 (Type II and Type III)
		0.10 to 0.30 (Type IV)
Flash point (open cup)	Degrees F	320 min
Fire point	Degrees F	350 min
Autoignition temp	Degrees F	750 min
R Particulate contamination	Class	Class 7 of NAS 1638

R New Hydraulic Fluid Physical Properties, LAC C-34-1224C (Cont)
Table 1

FLUID PROPERTY	UNIT	VALUE
R Total Chlorine Content (maximum)	PPM	75 PPM NOTE (1) (Type II and Type IV Class 2)
R		45 PPM NOTE (1) (Type III and Type IV Class 1)
R		80 PPM NOTE (2) (Type II and Type IV Class 2)
R		50 PPM NOTE (2) (Type III and Type IV Class 1)

R NOTE: (1) X-ray Fluorescence test method

R (2) Microcoulometer test method

Special paints and protective materials are used to prevent damage to areas that are susceptible to the effects of the phosphate-ester fluids. The purple nameplates on the hydraulic components indicate that fluid complying with
R Lockheed Specification C-34-1224C, Type IV, or a mixture of
R Type IV and Types II and/or III, must be used. The red nameplate on the landing gear shock strut assemblies indicate that a mineral-base red fluid (MIL-H-5606) must be used.

6. Hydraulic System Tubing

A. Description

Corrosion-resistant (CRES) seamless tubing is used for all hydraulic system pressure lines, and for all return and suction lines exposed to critical environmental conditions such as in the wheel wells, landing gears, and power plant fire zones (Ref. Table 2). Aluminum alloy 6061-T6 tubing is used for the remaining return and suction lines (Ref. Table 3). All hydraulic tubing 3/8-inch OD or smaller is made of corrosion-resistant steel. Aluminum lines are treated with a chemical film and are prime coated. In exposed areas, a topcoat is applied before or after detail assembly. All fittings are masked during in-place coating.

Corrosion Resistant Steel (21-6-9 CRES) Tubing
Table 2

TUBE OD	WALL THICKNESS	SUCTION	RETURN	PRESSURE
0.250	0.016		X	
0.375	0.020		X	
0.500	0.020		X	
0.500	0.026			X
0.625	0.020		X	
0.625	0.033			X
0.750	0.020			X
0.750	0.039			X
1.000	0.026		X	
1.000	0.052			X
1.250	0.032	X		

Aluminum Alloy (6061-T6) Tubing
Table 3

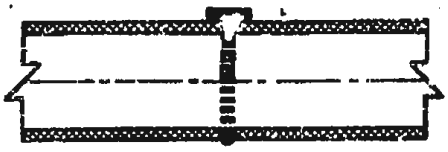
TUBE OD	WALL THICKNESS	SUCTION	RETURN
0.500	0.028		X
0.625	0.035		X
0.750	0.035	X	
0.750	0.042		X
1.000	0.049		X
1.250	0.028	X	
1.250	0.065		X

Hydraulic lines are routed to take advantage of primary structure for protection from damage and also from extreme temperatures, and exposure to corrosive fluids. Whenever possible, hydraulic lines are routed below electrical systems for safety. Tubing clamps and supports are designed to preclude wear to tubing.

Coiled CRES tubing is used for system connection points where small differential motion is encountered, such as spoilers and flight control actuators. Teflon hoses reinforced with CRES wire braid are used on pumps, landing gear, and units where relatively large differential motion is involved. Hoses with permanently attached end fittings only are to be used.

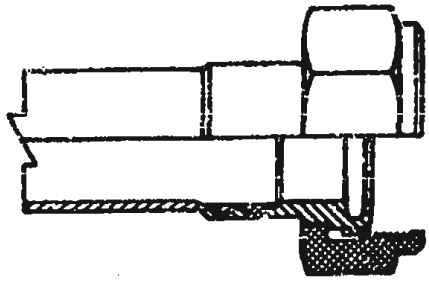
The hydraulic system CRES lines are connected by butt welding, wherever possible, to minimize the possibility of leakage (Ref. Fig. 9). Hydraulic fittings are used at the fuselage wing interface. Self-sealing disconnect fittings are used at the engine QEC disconnect points to prevent system fluid from draining during engine removal. Hydraulic line spacing is designed to permit on-aircraft repair using portable welding equipment. The aluminum alloy return and suction lines are connected by mechanical fittings.

All plumbing lines are identified by decal tapes that designate by color, code, and wording, the fluid system involved and the direction of flow. Tubing assembly part numbers are rubber stamped on all aluminum lines, and Electro-Chemical etched on CRES tubing assemblies.



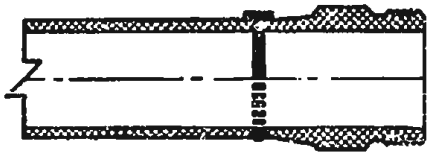
"T" WELD

TUBE TO TUBE

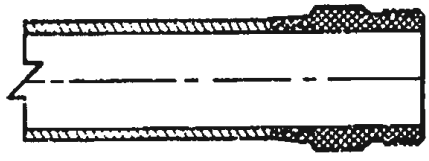


DYNATUBE SWAGE (FEMALE)

TUBE TO END FITTING

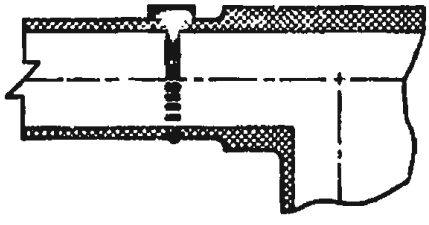


DYNATUBE "T" WELD



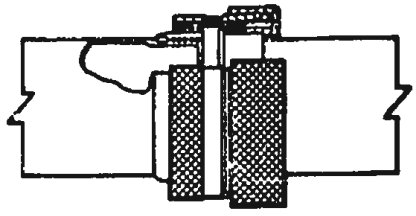
DYNATUBE SWAGE (MALE)

TUBE TO END FITTING



"T" WELD

TUBE TO FITTING



WIC-O-FLEX COUPLING

TUBE TO TUBE (FLANGES SWAGED)

HH 5476
M1-0101-29-002

Hydraulic Systems Permanent Connections
Figure 9

7. Hydraulic System Fittings

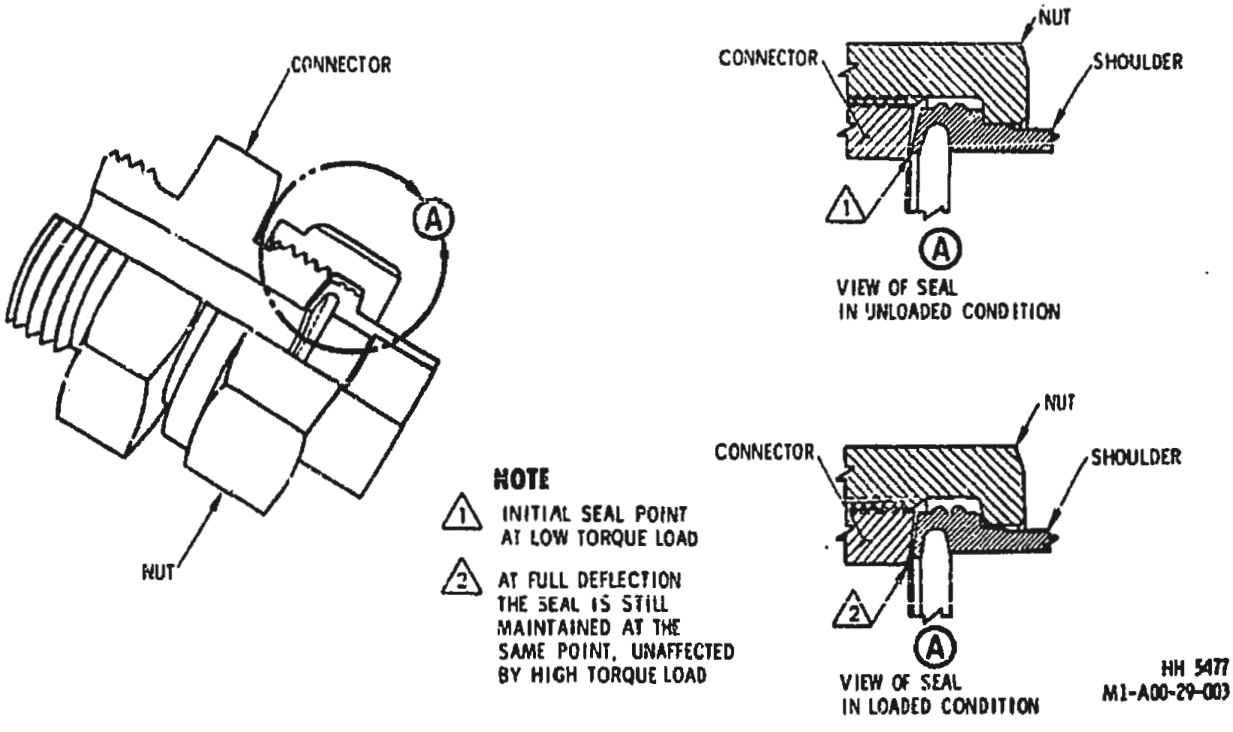
A. Description

Welded connections of tube-to-tube, tube-to-shape (tee, cross, elbow), and tube-to-end fittings are made with 17-4PH corrosion-resistant (CRES) Dynatube fittings (Ref. Fig. 9). Dynatube fittings with weldable ends are used for CRES lines where removable connections are required at the system components, aircraft component interfaces (wing to fuselage), and in plumbing T-fitting applications. Dynatube fittings are welded to tubing or are threaded into manifolds or units, as required. Dynatube swageable fittings are used on aluminum alloy system return lines and for repair of damaged lines (Ref. 20-29-02).

Titanium connectors, elbows, tees, crosses, and adapters are used for the male end Dynatube fitting where welding is not required.

The Dynatube fitting is a metal-to-metal seal using an integral Belleville-washer-type diaphragm that makes a seal at a very low torque value (Ref. Fig. 10). System pressure acts as a self-energizing metal-to-metal seal, adding additional hydraulic force to assist the compressive action of the diaphragm in achieving a seal. Dynaring washers may be used (only as a field expediency)(Ref. 20-29-02) for repairing leaking Dynatube connectors when the leak cannot be repaired by torquing or resurfacing the Dynatube male end. The washer must be replaced at any time the fitting is disconnected.

Wig-o-flex connectors are used on the hydraulic pump suction lines on aircraft 001-014 and Dynatube connectors on aircraft 015-999. The Wig-o-flex fitting (Ref. Fig 9) incorporates an O-ring seal and a flange swaged to the tube assembly (Ref. 28-20-01, 201 for typical installations).



Hydraulic System Fittings
Figure 10

HYDRAULIC POWER - MAINTENANCE PRACTICES

1. General

This section contains hydraulic fluid handling precautions and Hydraulic Service Center cleaning procedures (Para. 4).

2. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

3. Referenced Procedures

29-00-00 Hydraulic Power - Inspection and Check

29-11-00 Hydraulic Power System - Maintenance Practices

4. Hydraulic Fluid Handling

A. Safety Precautions

WARNING: LONG EXPOSURE TO HYDRAULIC FLUID CAN CAUSE SKIN DEHYDRATION AND CHAPPING.

(1) Apply barrier cream to hands, wrists, and forearms.

(2) Wear goggles when pressure-testing components or systems and at any time there is a possibility of fluid splashing into eyes.

(3) If fluid splashes into eyes, treat immediately by flushing thoroughly with clear cold water and report the incident.

(4) Wash skin exposed to fluid with soap and hot water.

(5) If clothing becomes soaked with fluid, remove it as soon as possible, thoroughly wash skin and put on clean clothing.

B. Maintenance Precautions

WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF. 29-11-00,201).

R CAUTION: HYDRAULIC FLUID WILL ATTACK A WIDE RANGE OF
R MATERIALS INCLUDING RUBBER, COPPER, STEEL,
TITANIUM, VARIOUS PLASTICS, AND PAINT.

(1) Ensure that hydraulic fluid does not come into contact with any part of aircraft outside of hydraulic system. Keep spillage to an absolute minimum.

(2) Remove spilled fluid immediately to prevent entry into adjacent areas and the possibility of future false reports of hydraulic leaks. Wipe up fluid with a dry cloth and wash contaminated area.

(3) When washing metal parts before assembly, use only denatured alcohol, Stoddard solvent or equivalent and ensure that all traces of the solvent are removed before assembly.

(4) Use only clean hydraulic fluid LAC Spec C-34-1224 or equivalent for flushing or testing hydraulic components.

(5) Lubricate O-rings and seals only with clean hydraulic fluid immediately before assembly or installation.

C. Hydraulic Service Center Cleaning Procedure

Accumulated leakage, spillage, and dirt may be removed from the hydraulic service center as follows:

(1) Wipe spill areas with clean dry cloths until surfaces are dry.

(2) Remove remaining residue with alkaline cleaner such as Turco 5948 or Brulin 715N in accordance with the manufacturers instructions on the container.

(3) Rinse area with clean water and dry.

HYDRAULIC POWER - INSPECTION AND CHECK

1. Hydraulic Fluid Sampling

Fluid samples of each hydraulic system should be taken at periodic intervals and analyzed for fluid properties as shown in Table 601. If any of the fluid in-service limits are exceeded, a system flushing procedure must be performed to replace fluid with clean fluid and bring system fluid properties within limits.

NOTE: High particle count may indicate that the return filter element has a break or hole that is allowing particles to pass through.

2. Equipment and Materials

C Fluid Sampling Bottles, Polyethylene, or equivalent (Alternate:
C TWA Stk. Nbr. 48-1652, 1-Qt. Sample Can)

Fluid Container, open top, one gallon, or equivalent

C Hydraulic Fluid, LAC Spec C-34-1224 (Compatible with Boeing
C BM53-11 and Douglas DMS 2014 Fluid Specifications).

3. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

Hydraulic Fluid Property Limits
Table 601

FLUID PROPERTIES	TEST METHOD	IN-SERVICE FLUID LIMITS
Appearance	visual	blue/purple to gray No cloudiness or precipitation
Specific Gravity	ASTM D941	1.000 - 1.072
Water Content, percent by wt	ASTM D1744	0.4 - 0.60
Neutralization No. mg KoH/g	ASTM D974	1.5 (maximum)
Viscosity, CS at 100 deg F	ASTM D445	7.0 (minimum)
Flash Point	ASTM D92	320 deg F
Particle Contamination	ARP 598	Class 8 of NAS 1638

4. Inspection/Check

A. Hydraulic Fluid Sampling

NOTE: Cleanness and consistency are the important factors to consider during fluid sampling procedures.

Very small amounts of contamination introduced into the fluid sample during the sampling procedure will result in a very large affect on the particle count and will not indicate the condition of the total system.

CAUTION: FLUID SAMPLES MUST BE TAKEN IN CLEAN BOTTLES OR CANS, PREFERABLY POLYETHYLENE. IF BOTTLES ARE NOT CLEANED PER THE FOLLOWING PROCEDURE, FLUID SAMPLES MAY BE INVALID.

(1) Prepare bottle for obtaining fluid sample as follows:

(a) Rinse three times with minimum 50 ml clean naptha or petroleum ether. Discard the solvent rinsing agent.

(b) Rinse outside of bottle with clean petroleum ether from squirt bottle.

C C (c) Place cap on bottle and seal in clean polyethylene bag until ready to use.

(2) On Flight Engineer/Second Officers overhead circuit breaker panel C82, zone 215, verify that the following HYDRAULIC circuit breakers are closed:

AC PUMP B3 (L12)

PTU CONT & IND SYS B-A (L14)

PTU CONT & IND SYS C-D (L15)

AC PUMP C3 (L22)

(3) Turn on electrical power (Ref. 24-41-00).

(4) Open hydraulic service center access doors 147AB and 147BB.

(5) Remove caps from sampling ports on applicable system return filter modules (Ref. Fig. 601).

(6) Clean sampling port fittings with isopropyl alcohol TWA Stk. Nbr. 50-0143 and wipe with lint-free wipes and flush again with alcohol.

NOTE: If a sampling tube is used to obtain fluid, it must be thoroughly cleaned and rinsed lint and dirt free.

R R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

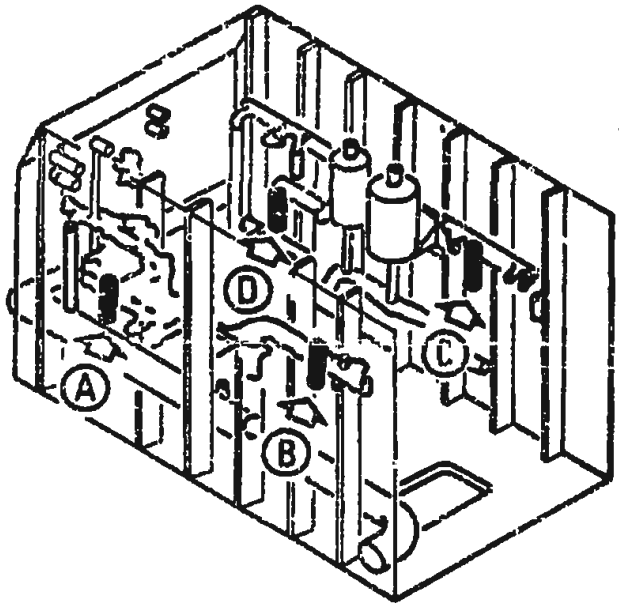
CR PITCH TRIM WHEEL SET AT ZERO DEGREES.

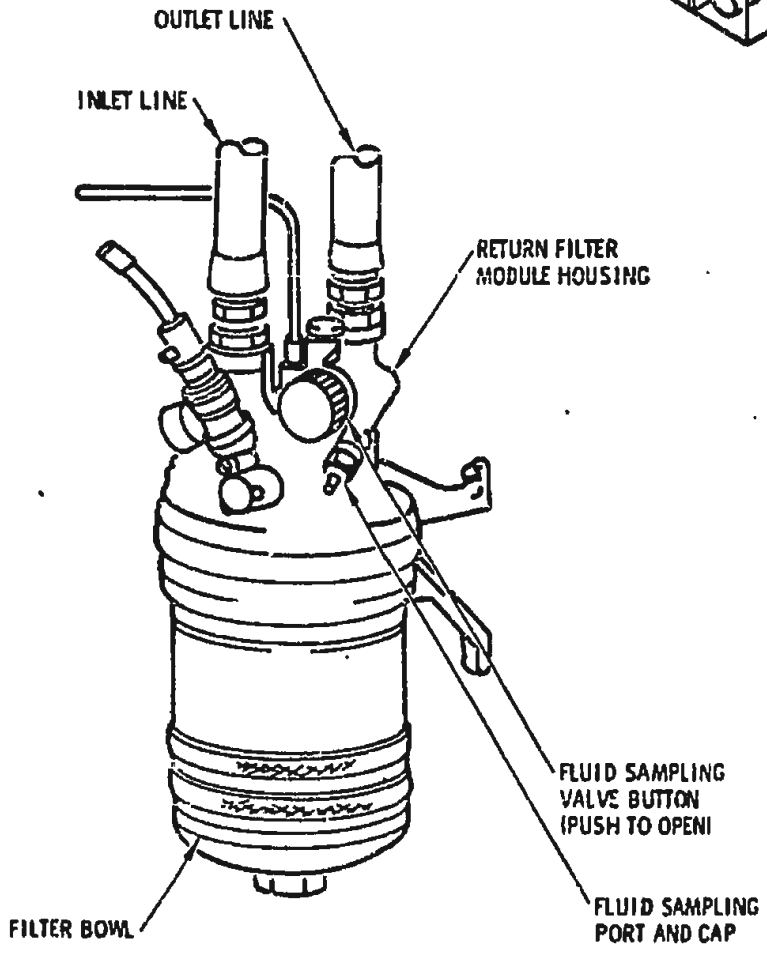
CR CR CR CR LANDING GEAR DOWNLOCK SAFETY PINS INSTALLED IF REQUIRED PER GP&P 7-4-0 AND DOOR SAFETY DEVICES ARE INSTALLED IF DOORS ARE OPEN AND WORK IS TO BE PERFORMED IN WHEEL WELL.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Pressurize hydraulic systems A, B, C, and D as follows (Ref. 29-11-00):





M1-0001-29-200

CR
CR

Hydraulic Fluid Sampling Valve
Figure 601

EFFECTIVITY: ALL

001B

(a) On HYDRAULIC SERVICE PANEL, zone 147, lift guards and place AC MOTOR PUMP B3 and C3 toggle switches to ON.

(b) Lift guards and position POWER TRANSFER UNIT B-A and C-D momentary switches to START; observe that the PTU indicator lights come on.

CR C (8) Cycle horizontal stabilizer at maximum rate for 5 minutes.

CR NOTE: Do not cycle stabilizer during fluid sampling.

(9) Place fluid container under system A sampling port with space provisions to insert sampling bottle into fluid stream without stopping fluid flow.

(10) Depress sampling valve on system A return filter module and allow at least 1 quart of fluid to run into fluid container. Do not release valve until sample has been obtained.

(a) Remove cap from sample bottle and with valve still depressed collect 100 ml of hydraulic fluid in sample bottle; remove bottle from fluid stream and then release sampling valve.

(b) Place cap on bottle immediately.

C C C (c) Identify fluid sample with the following details on the container/bottle label or on a tag affixed securely to the container:

C Aircraft number and hydraulic system (A-B-C-D)

C Date

C Station

C Mark as HYDRAULIC FLUID SAMPLE

C (d) Replace cap on sampling port and tighten.

CR C (11) Ship to the location specified by the MCI Maintenance Coordinator or Engineering.

(12) To obtain fluid samples from systems B, C, and D, repeat Steps (8) through (9) on the applicable return filter modules.

(13) Turn off AC MOTOR PUMPS B3 and C3, and POWER TRANSFER UNITS B-A and C-D.

(14) Verify that fluid sampling port caps are replaced and tightened.

(15) Perform RESERVOIR FLUID QUANTITY check in accordance with instructions on RESERVOIR SERVICING INSTRUCTIONS placard and HYDRAULIC SERVICE PANEL. Replenish fluid as required (Ref. 12-13-01).

(16) Turn off electrical power (Ref. 24-41-00).

(17) Close and lock hydraulic service center access doors.

C 5. External Leakage Check

C A. General

C The following leakage check and chart provides allowable
C external leakage rates for various possible leakage sources.
C The rates are calculated to be tolerable without adversely
C affecting component or system operation. Each incident
C should be considered in conjunction with total system
C condition, flight duration, and maintenance time and
C facilities available. Evaluate individual component seal
C leaks and total leakage for each system using following
C guide lines:

CR NOTE: Before changing an aileron or rudder servo that is
CR leaking from the static cavity relief valve, first
CR replace the valve (TWA Stk. Nbr. 73-6866) (Drain line
CR is attached to relief valve).

CR On rudder and left inboard aileron servo, some
C outflow from static cavity relief valves, under
C specific conditions, is normal. Operation of servo
C with one hydraulic system deactivated allows coupler
CR piston in servo to be displaced. Repressurization
CR forces excess hydraulic fluid out pressure relief
CR valve. Maximum flow caused by this condition is
CR approximately 7.0 cc/min.

CR If, after replacing the relief valve, leakage is
CR still excessive, contact MCIMD to have correction to
CR leakage setup.

CR Aircraft dispatch is permissible providing hydraulic
CR fluid servicing has not been required on previous
CR flight legs with associated hydraulic systems.

C CAUTION: DO NOT INSTALL A PRESSURE CAP ON THE RELIEF VALVE
C FITTING OR THE SERVO MAY BE DAMAGED.

C (1) When possible, actuate components through at least six
C full cycles prior to performing a leakage check.

C (2) Dynamic seals should also be checked for leakage while
C in a static condition. Many components cannot be
C closely monitored while operating due to their
C location.

C (3) Examine all static seal leakage as possibly leaking due
C to housing cracks; such leakage increases with
C pressure. No leakage is allowable from a cracked
C housing.

C (4) When a dispatch with an allowable rate leak is made,
C observe the following:

C (a) All reservoirs must be at maximum full level.

C (b) Recheck at all intermediate stops.

CR (5) Allowable leakage of hydraulic components

CR (a) The following leakage check chart provides recommended and authorized external leakage rates for the defined various possible leakage sources. These rates have been determined to be tolerable without adversely affecting component or system operation.

CR (b) The external leakage limits are presented in three classifications, namely:

CR • Condition A

CR Allowable leakage for continuing normal operations with no corrective action required.

CR NOTE: Hydraulic leakage which results in a flight delay must be set up for correction even though leakage is within CONDITION A limits. MCIMD shall determine where repairs are to be made.

CR • Condition B

CR Allowable leakage for flight dispatch to avoid a delay.

CR NOTE: MCIMD shall determine where an airplane, operating within the CONDITION B limits, shall be repaired. The subject airplane may continue the flight or a series of flights within the condition B limits but may not depart from the station designated by MCIMD without being repaired.

CR • Condition C

CR When the detected leakage exceeds the limits of CONDITION B, the leakage shall be corrected to at least the maximum limits of CONDITION A before further operations.

CR (c) These limits do not apply to leakages caused by obvious failures such as cracks in component bodies or excessive wear, cracks or pin holes in tubing/hose fittings or assemblies.

CR (d) These limits are intended to serve as a guideline
CR to determine whether leaking hydraulic components
CR are serviceable. In all cases, good judgement
CR should be used to determine if replacement is
CR necessary.

CR (e) All leakage checks shall be conducted with the
CR airplane hydraulic system(s) pressurized to the
CR normal dispatch pressure.

CR (f) Where possible, actuate the leaking components
CR through several full cycles before performing the
CR leakage check.

	CONDITION A LEAKAGE ALLOWABLE FOR NORMAL OPERATION (No Correction Required)	CONDITION B LEAKAGE ALLOWABLE FOR DISPATCH TO AVOID DELAY
	NOTE: If leakage results in flight delay, corrective action must be set up. MCIMD will determine where repairs are to be made	NOTE: The airplane may continue the flight or series of flights within these limits, but may not depart the station designated by MCIMD without being repaired.
All seals dynamic and static	4 DPM (Drops Per Minute)	5 to 30 DPM. Correct to 4 DPM max when designated by MCIMD
Hydraulic pump shaft seals, engine and electric driven	10 DPM per pump	30 DPM per pump.
Tube connections and hoses	None	None

CR 6. Hydraulic Fluid Clean-up After a Fluid Leak

C A. It is well-known that commercial aircraft hydraulic fluid (phosphate ester base) will strip some paints and soften certain plastic and rubber compounds. What may not be too well-known is the effect they may have on some steel and titanium metals. Hydraulic fluid leakage on titanium or steel parts can cause embrittlement and the potential for the subsequent failure of the affected part. The embrittlement is caused by the decomposition of the fluid into the phosphoric acid residue. This decomposition rate commences at approximately 270•F and accelerates as the temperature increases. Hot pneumatic ducts and the engine pylon areas are most susceptible to this condition because of the hot environment.

C B. Special attention should, therefore, be given to removing all hydraulic fluid from leakage and spills to prevent any reaction with the adjacent surfaces even though the temperature may be less then 270•F. The fluid should be removed immediately with an alkaline cleaner such as Leader Chemical 140-B, TWA Stk Nbr 50-1301, and a clear water rinse.

HYDRAULIC SYSTEM CONTROL PANEL - MAINTENANCE PRACTICES

1. Equipment and Materials

Breakaway Wire, Fed Spec. QQ-W-321, 0.0125-inch diameter

2. Referenced Procedures

20-33-01 Switchlight (Square) - Removal and Installation

24-41-00 External Power/Ground Service System - Maintenance Practices

3. Maintenance Practices

A. Relamping RAM AIR TURBINE Switchlight

(1) Open and tag the following circuit breakers:

R (a) On the pilots overhead circuit breaker panel CB1,

R RAT MAN DEPLOY (B14)

R IND LT RAT (H10)

R (2) On RAM AIR TURBINE switchlight, remove breakaway wire
R and raise guard.

R (3) Grasp lens assembly by finger indentations and pull
R outward (Ref. 20-33-01). Allow lens assembly to hang by retainer.

(4) Remove defective lamp.

(5) Install replacement lamp.

(6) Insert lens assembly into switchlight housing with the placard TOP facing up.

(7) Turn on electrical power (Ref. 24-41-00).

(8) On Flight Engineer/Second Officers LIGHTS panel, zone 215, depress WARNING/CAUTION/ADVISORY - TEST switchlight. Verify that replaced lamp comes on.

(9) Close switchlight guard.

(10) Install breakaway wire.

(11) Remove tags and close circuit breakers opened in Step 3A(1).

HYDRAULIC POWER SYSTEM - DESCRIPTION AND OPERATION

1. General

The four hydraulic systems (A, B, C, and D) are used to operate primary and secondary flight controls, landing gear extension and retraction, brakes, and nose gear steering (Ref. Fig. 1). The four separate and independent systems are each powered by an engine-driven hydraulic pump. Secondary or supplemental power is supplied by two air turbine motor (ATM) driven hydraulic pumps and by two power transfer units (PTU) motor-pump combination. An electric motor-driven hydraulic pump in systems B and C provides on-board hydraulic power capability for ground maintenance of the hydraulic system. The pumps can also be used for supplemental power during flight. Auxiliary or emergency power is supplied by a ram air turbine (RAT).

The hydraulic power system components that supply fluid, pressure, filtration, pressure regulation and deliver hydraulic power to the aircraft hydraulic units and systems are covered in the following paragraphs.

For information concerning power distribution, system schematics and component locations reference 29-00-00.

2. Hydraulic Bootstrap Reservoirs

A. Description

Each hydraulic system has a reservoir incorporating a fluid level indicator and fluid low-level warning unit, connections for return fluid, pump supply, system pressure, overboard relief, and reservoir drain. Fluid temperature probe, thermal switch and depressurization units are also provided. Pressurization of the hydraulic fluid in the reservoir is accomplished by the bootstrap principle (system pressure acting on the pressure-reducing piston). This provides pressure (85 psi) on the system return and pump supply fluid. Reservoir pressure is indicated on gages on the HYDRAULIC SERVICE PANEL. The large piston in the reservoir section and the pressurizing piston (area ratio 36 to 1) are connected together to provide the bootstrap principle by which the hydraulic system pressure pressurizes
R the reservoir fluid. The pressure relief and dump valves
R prevent overpressurization. The tank capacity of reservoirs A, B, and D is 5.7 gallons each; the tank capacity of reservoir C is 12.5 gallons (Ref. Fig. 1). The normal operating (full) levels of the reservoirs are only a fraction of the tank capacities as follows: 3.1 gallons for

system A, 2.8 gallons for system B, 5.7 gallons for system C, and 2.2 gallons for system D. The reservoirs are mounted on the right and left sidewalls of the hydraulic service center, zone 147.

B. Operation

A depressurization valve on the base of the reservoir and a bleed valve at the bottom of the pressurizing piston enable air to be released from the reservoir during maintenance operations. Operating the depressurization valve equalizes pressure between the reservoir piston and the pressurizing piston which permits air entrapped in the fluid to separate and accumulate below the reservoir piston. Releasing the spring-loaded depressurization valve reapplies pressure to the reservoir (85 PSI indicated on the reservoir pressure gage on HYDRAULIC SERVICE PANEL). Opening the air bleed valve allows the air accumulated below the reservoir piston to be removed through the sliding tube inside the hollow piston rod attached to the air bleed valve.

R 3. Variable Delivery Hydraulic Pumps - Engine and ATM-driven

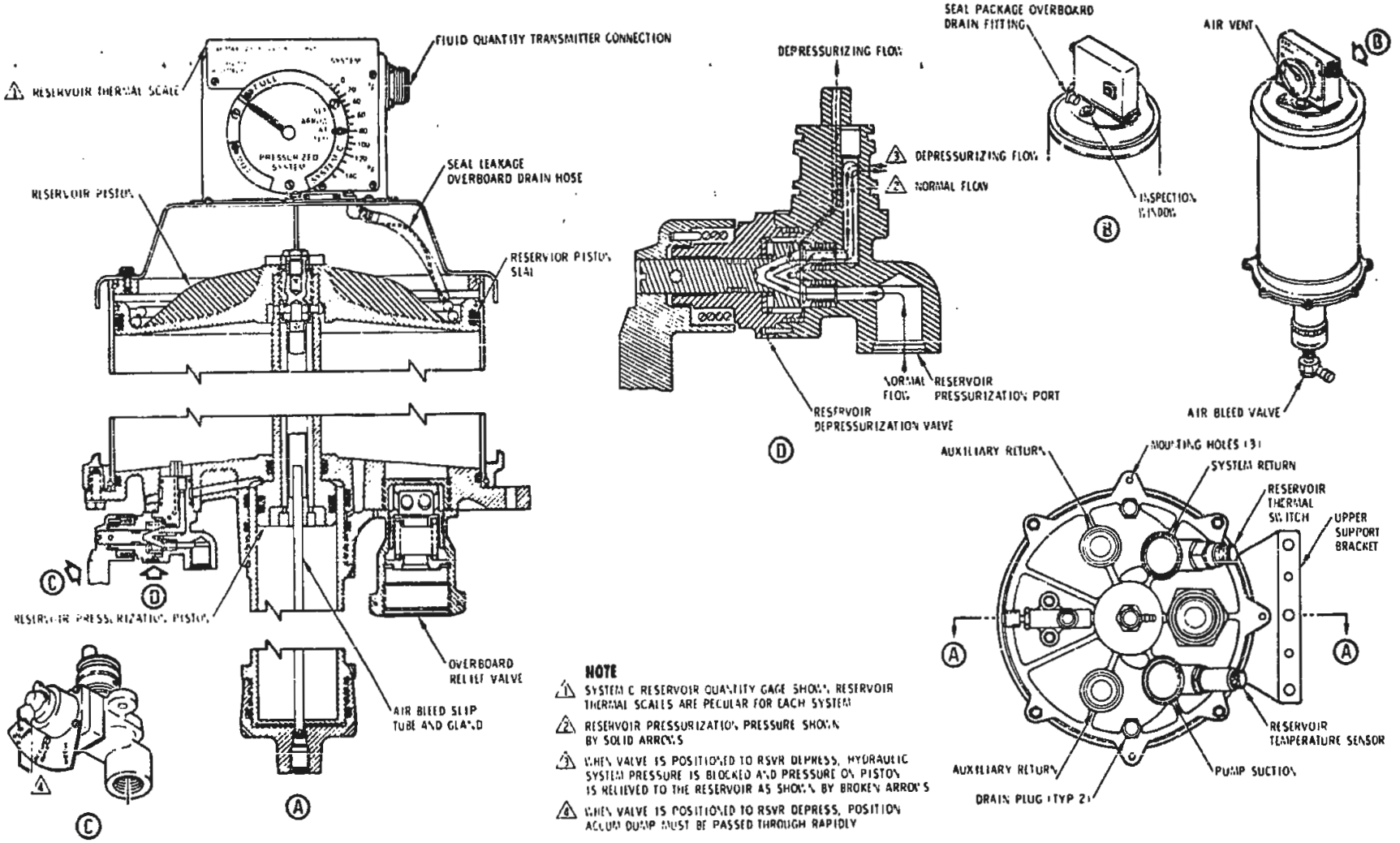
A. Description

The engine-and ATM-driven hydraulic pumps are pressure-compensated, variable-displacement, electrically depressurized hydraulic pumps. The pumps deliver hydraulic fluid in varying volume (as required) to operate the equipment in the hydraulic systems. The pump consists of the following major components: mounting flange, housing, rotating group, and valve block (Ref. Fig. 2).

The mounting flange, located at the coupling shaft end of the pump, provides attachment of the pump to the prime mover (engine accessory gearbox or ATM gearbox).

The housing contains the pumping mechanism components (rotating group), the cylinder block, nine piston and shoe assemblies, the yoke, and the drive shaft. The cylinder block and wafer plate are held against the adapter block by spring action and hydraulic pressure. The cylinder block is splined to, and driven by, the drive shaft.

The yoke is supported in the mounting flange on two yoke pintle bearings and swivels through an arc of 0 to 17.5 degrees. The angle of the yoke is controlled by outlet fluid pressure acting on the actuator piston through the pressure compensator valve. Control springs move the yoke to the maximum angle when outlet pressure is less than the pressure compensator valve setting. The piston and shoe



NOTE

1. SYSTEM C RESERVOIR QUANTITY GAGE SHOWN. RESERVOIR THERMAL SCALES ARE PECULAR FOR EACH SYSTEM
2. RESERVOIR PRESSURIZATION PRESSURE SHOWN BY SOLID ARROWS
3. WHEN VALVE IS POSITIONED TO RSVR DEPRESS, HYDRAULIC SYSTEM PRESSURE IS BLOCKED AND PRESSURE ON PISTON IS RELIEVED TO THE RESERVOIR AS SHOWN BY BROKEN ARROWS
4. WHEN VALVE IS POSITIONED TO RSVR DEPRESS, POSITION ACCUM DUMP MUST BE PASSED THROUGH RAPIDLY

311-0100-29-279

Hydraulic System Reservoir (Typical)
Figure 1

R
R
0018 EFFECTIVITY: ALL

subassemblies are retained in the yoke by a holddown plate. The wafer plate, located between the cylinder block and adapter block provides the valving action to direct fluid flow to and away from the cylinder block. The impeller is keyed to the drive shaft. The impeller permits pump full-flow operation with an inlet pressure as low as 5 psia.

The valve block includes the pressure compensator valve, the solenoid-operated depressurizing valve, and the outlet blocking valve. The inlet, outlet, and case drain ports are an integral part of the valve block.

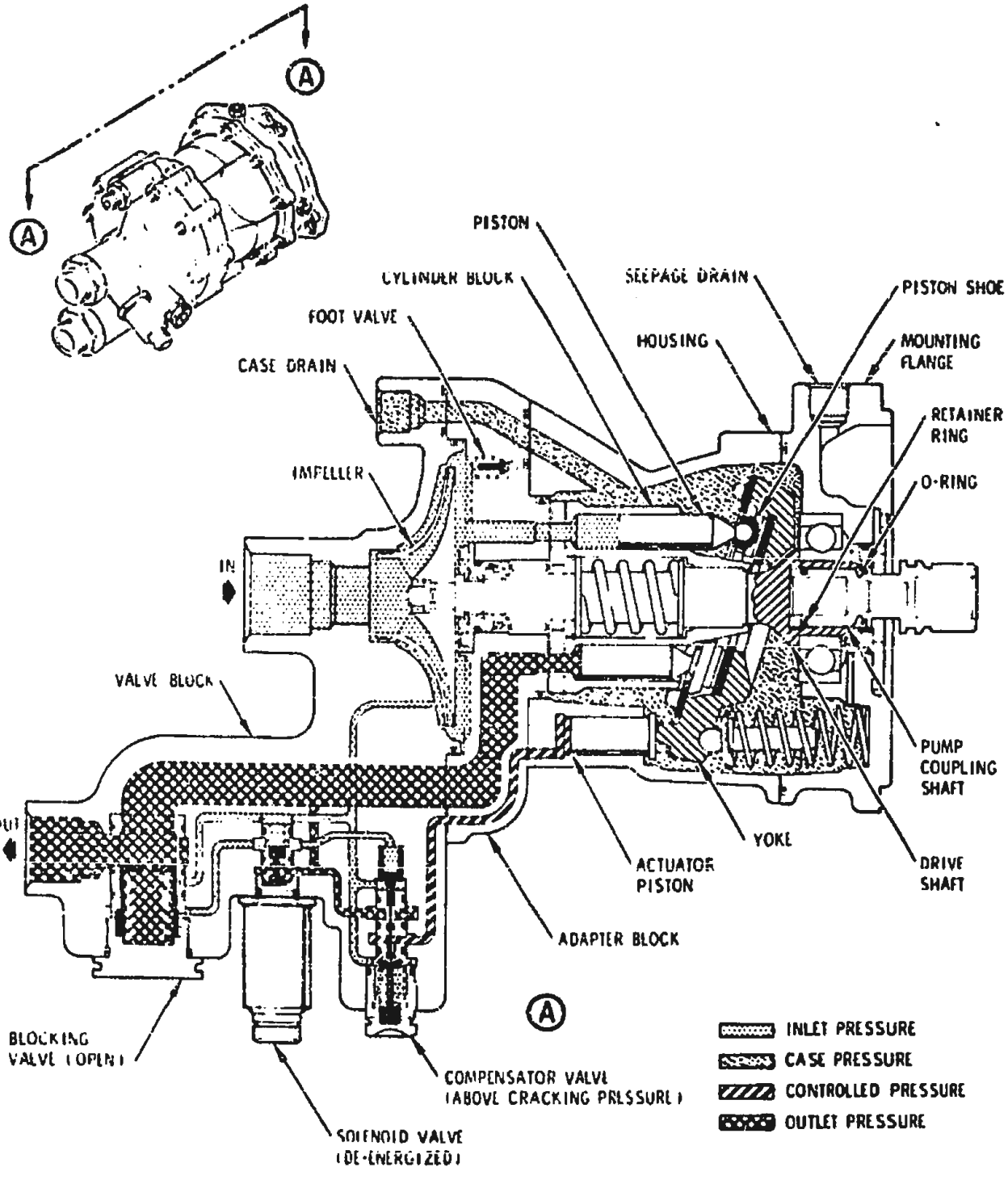
B. Operation

Pump output capacity is proportional to the driven speed. Normal speed will vary from approximately 2480 to 3880 rpm.
R In this speed range, the maximum pump flow capability will vary from 24.8 to 38.8 gpm. Pump delivery decreases when system pressure reaches 2850 psi. The pressure compensator valve directs pressure to the actuator which positions the yoke toward the 0-degree angle. When system pressure reaches 3025 (±50) psi, the pump will have no output flow (except for case drain flow).

Normal reservoir pressure of 78 to 85 psi will direct the hydraulic fluid into the inlet port of the valve block under pressure. The fluid is supercharged by the impeller and forced into the bores of the cylinder block. The impeller and cylinder block are driven by the drive shaft which, in turn, is connected to the prime mover by the coupling shaft.

At any pressure less than the setting of the pressure compensator valve, the yoke is moved to the maximum displacement position by the control springs. Fluid enters the bores of the cylinder block on the outward stroke of the pistons and is discharged through the outlet port by the inward stroke. As pressure in the outlet line builds up to the setting of the pressure compensator valve, some of the pressure is metered to the actuator piston. Action of this piston decreases yoke angle and, consequently, outlet flow.

Manual control of pump output is provided by the solenoid-operated depressurizing valve. When the valve is activated, hydraulic fluid is directed to the actuator piston to decrease yoke angle. In normal pump operation, the pressure is 3025 (±50) psig. When depressurized, pump outlet pressure is reduced to zero, and the pump will develop whatever internal pressure is required to move the yoke to a near-zero position. This pressure is approximately 800 psig. In addition, fluid flow generated by pump operation which is reduced to approximately 1.5 gpm, is discharged through the case drain port. This flow



Variable Delivery Hydraulic Pump Schematic
Figure 2

provides lubrication and cooling for pump components. In the depressurized mode of operation, the load on the pump and the power required to drive the pump are reduced.

The outlet blocking valve is used in conjunction with the solenoid-operated depressurizing valve to isolate the pump from the rest of the hydraulic system during periods of depressurization (Ref. Fig. 3 and 4). The blocking valve can also isolate the pump in the event of system failure. The outlet blocking valve is spring-loaded to the closed position. Approximately 1000 psi outlet pressure is required to open the valve.

The four engine-driven hydraulic pump depressurization switchlights are located on the Flight Engineer/Second Officer HYDRAULIC SYSTEM control panel, zone 215. The pump is also placed in the depressurized mode when the emergency engine shutoff handle (FIRE PULL) located on the pilots overhead panel, zone 210, is pulled.

Four suction shutoff switchlights provide control of the firewall shutoff valves independently of the engine shutdown handles. Use of these controls would be to prevent loss of system fluid caused by severe leakage at the engine-driven pump. Damage to the pump would result from continued operation in this mode and would be considered only in an extreme emergency.

4. Air Turbine Motor (ATM)

A. Description

There are two ATM geared to systems B and C hydraulic pumps. The ATM-driven hydraulic pumps (identical and interchangeable with the engine-driven pumps), provide hydraulic pressure whenever the main hydraulic system
R pressure drops below 2600 (±50) psi. The system includes
R two ATM, an ATM controller, two rotary control switches, two
R tachometers, two lube underpressure switches, and two lube
R overtemperature switches with their corresponding LUBE HI
R TEMP and LO PR indicator lights (Ref. Fig. 5 and 6). The indicator light switches are armed only when the associated ATM is operating. (Ref. 29-33-00).

The ATM are installed in the left and right main landing gear wheel well fairings, zones 195 and 196. The rotary control switches, air turbine tachometers, and LUBE HI TEMP/LO PR caution indicator lights are on the HYDRAULIC SYSTEM control panel, zone 215. The ATM controller is installed in the mid electrical service center, zone 137.

NOTE: The ATM Controller has a safety circuit added to initiate shutdown if the overspeed safety monitor is lost.

R

Compressed air, normally supplied by the APU or engine bleed air, drives the ATM turbine wheel. Power is transmitted through the integral gearbox to the hydraulic pump. Speed control is achieved by monitoring the turbine speed with two speed sensors, and regulating that speed with an electronic controller and an air control valve.

Caution lights for the ATM CASE DRAIN HIGH TEMP and ATM OUTPUT LOW PRESS monitor the ATM-driven hydraulic pumps. The caution lights are on the HYDRAULIC SYSTEM control panel, zone 215. The switches that control these lights are armed only when the ATM is in the ON or OVSP TEST mode.

One ATM-driven hydraulic pump pressurizes system C and is mounted on the right side, zone 196. The other ATM-driven hydraulic pump pressurizes system B and is mounted on the left side of the aircraft, zone 195.

B. Operation

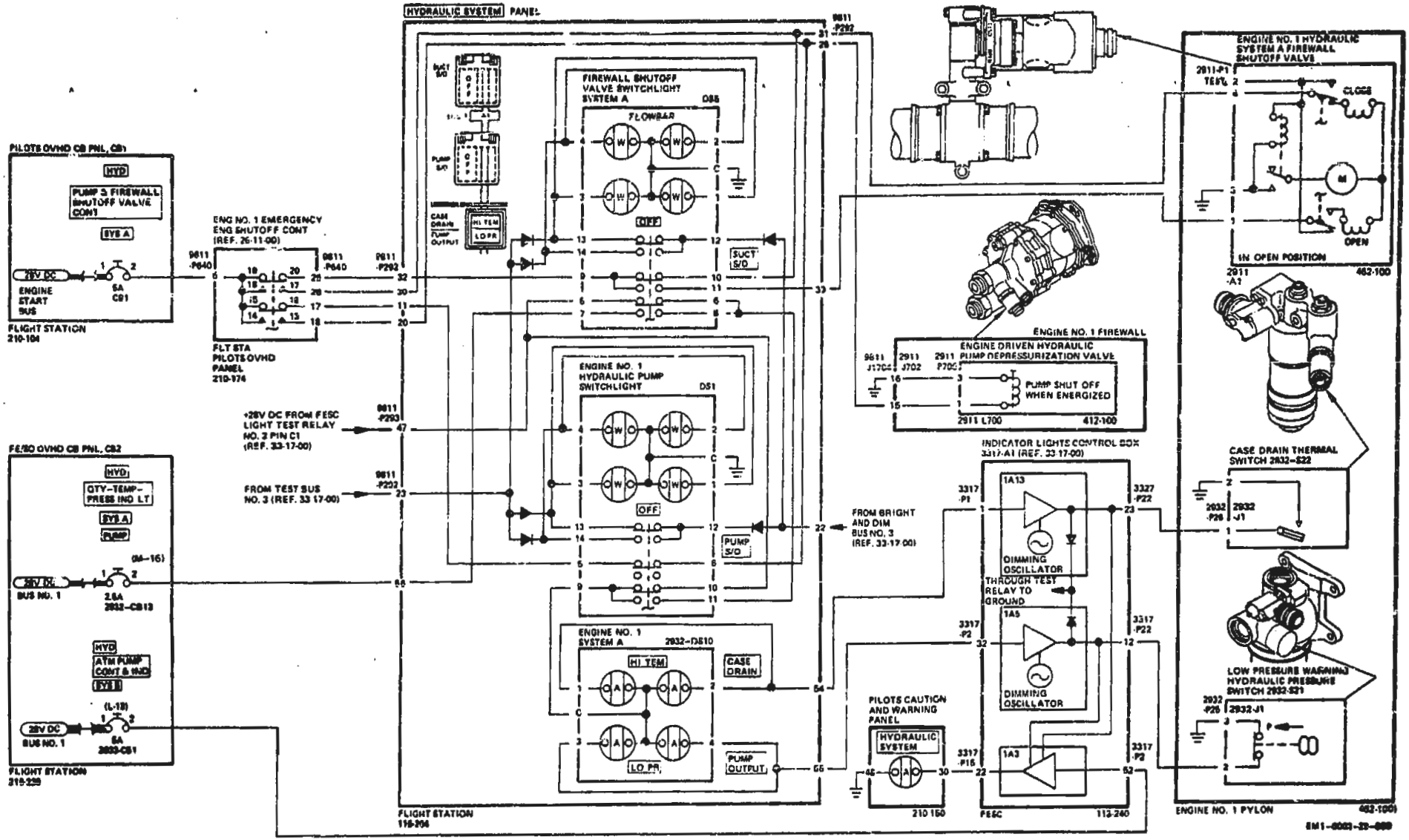
Operation of the ATM pumps (Ref. Fig. 7) can be initiated either automatically or manually from the HYDRAULIC SYSTEM control panel. The rotary control switches select the operating mode for each system. The switch positions are OFF, AUTO, ON, and OVSP TEST.

(1) AUTO Position Operation

During AUTO position operation, the ATM will be energized whenever the affected system pressure (B or C) falls below 2600 (±50) psi. The command logic will open the on/off valve and the servo valve. The magnetic pulse from the turbine provides a pulse that is compared with a reference pulse. The differential between the two pulses determines the current value to regulate the opening size of the servo valve. The overspeed detector will close the servo valve and the on/off valve when turbine speed exceeds 125 percent of nominal speed. Both valves will also close if the hydraulic system pressure exceeds 2850 (±50) psi. A time delay of 15 to 20 seconds after reaching 2850 psi prevents undesirable cycling of the system.

(2) ON Position Operation

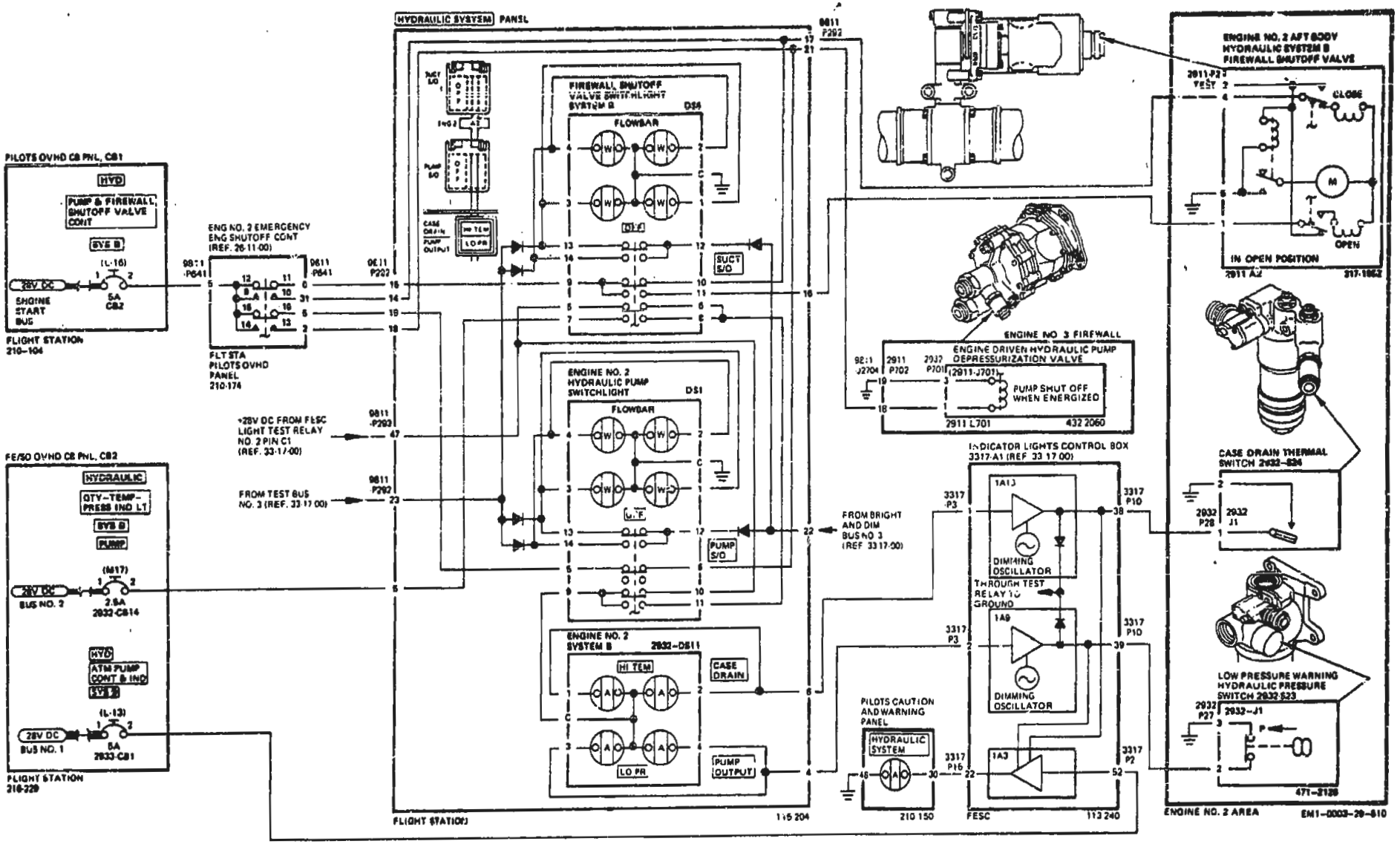
In the ON position, the command logic will open the on/off valve and the servo valve in the same manner as


HYDRAULIC SYSTEM PANEL
FIREWALL SHUTOFF VALVE SWITCHLIGHT SYSTEM A
ENGINE NO. 1 HYDRAULIC PUMP SWITCHLIGHT
ENGINE NO. 1 SYSTEM A
PILOTS OVHD CB PNL, CB1
PUMP S FIREWALL SHUTOFF VALVE CONT
ENGINE START BUS
FLIGHT STATION 210-104
ENG NO. 1 EMERGENCY ENG SHUTOFF CONT (REF. 26-11-00)
FLT STA PILOTS OVHD PANEL 210-974
F/E/O OVHD CB PNL, CB2
QTY-TEMP-PRESS IND LT
ATM PUMP CONT & IND
BUS NO. 1
FLIGHT STATION 210-229
+28V DC FROM FESC LIGHT TEST RELAY NO. 2 PIN C1 (REF. 33-17-00)
FROM TEST BUS NO. 3 (REF. 33-17-00)
FROM BRIGHT AND DIM BUS NO. 3 (REF. 33-17-00)
ENGINE DRIVEN HYDRAULIC PUMP DEPRESSURIZATION VALVE
PUMP SHUT OFF WHEN ENERGIZED
ENGINE NO. 1 FIREWALL
INDICATOR LIGHTS CONTROL BOX 3317-A1 (REF. 33-17-00)
DIMMING OSCILLATOR
THROUGH TEST RELAY TO GROUND
PILOTS CAUTION AND WARNING PANEL
HYDRAULIC SYSTEM
210-150
FESC
113-240
ENGINE NO. 1 HYDRAULIC SYSTEM A FIREWALL SHUTOFF VALVE
CLOSE
OPEN
IN OPEN POSITION
CASE DRAIN THERMAL SWITCH 2932-S22
LOW PRESSURE WARNING HYDRAULIC PRESSURE SWITCH 2932-S21
ENGINE NO. 1 PYLON

R Engine-driven Pumps Electrical Schematic
R Figure 3 (Sheet 1)

EFFECTIVITY: ALL

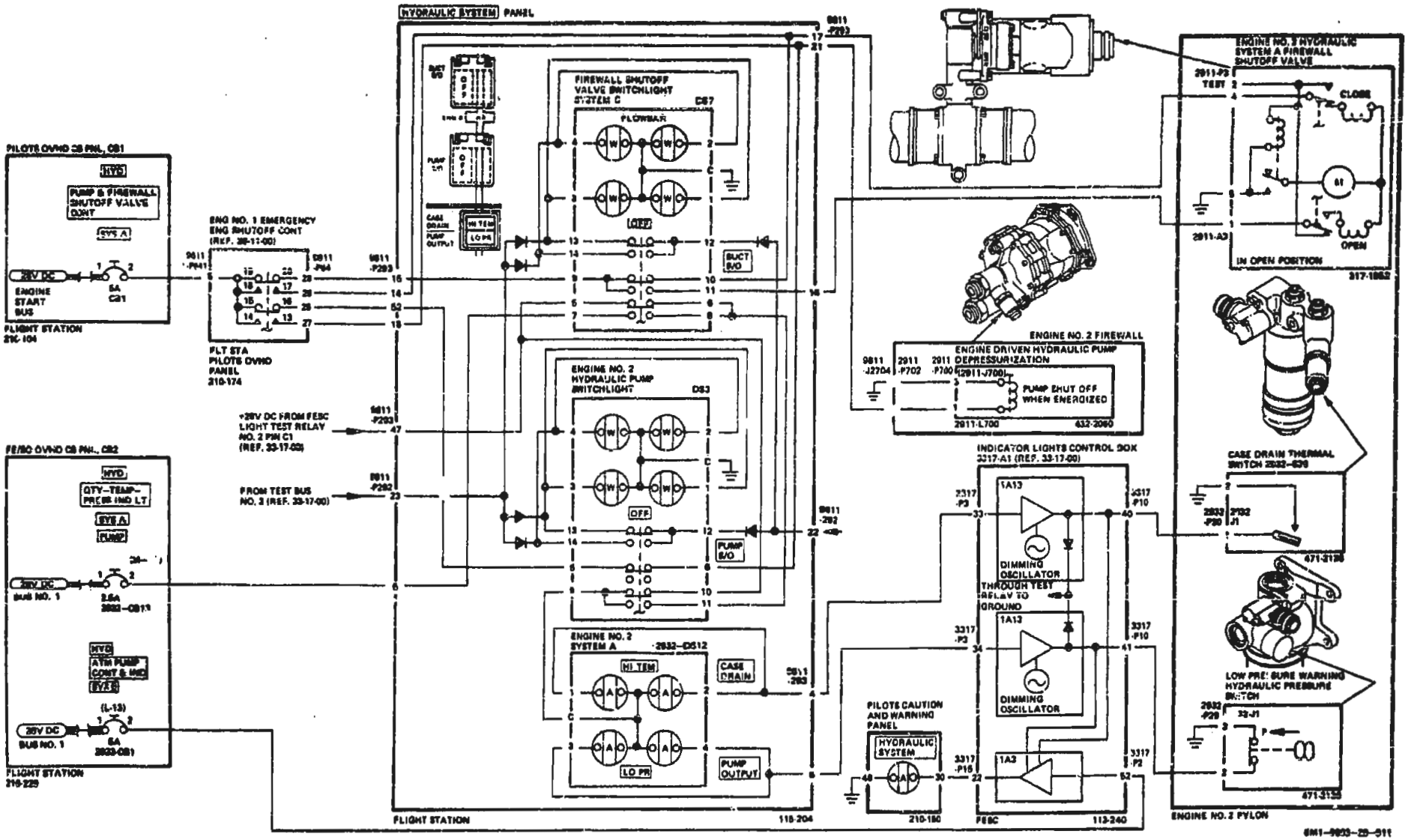
001B



R Engine-driven Pumps Electrical Schematic
R Figure 3 (Sheet 2)

EFFECTIVITY: ALL

001B


HYDRAULIC SYSTEM PANEL
FIREWALL SHUTOFF VALVE SWITCHLIGHT SYSTEM C DS7
ENGINE NO. 2 HYDRAULIC PUMP SWITCHLIGHT DS3
ENGINE NO. 2 SYSTEM A -2032-DS12
ENG NO. 1 EMERGENCY ENG SHUTOFF CONT (REF. 28-11-00)
PILOTS OVHD CB PNL, CB1
PUMP & FIREWALL SHUTOFF VALVE CONT
ENGINE START BUS
FLT STA PILOTS OVHD PANEL 210-174
FLIGHT STATION 210-104
FE/EC OVHD CB PNL, CB2
QTY-TEMP-PRESS IND LT
ATM PUMP CONT & IND
FLIGHT STATION 210-229
+28V DC FROM FESC LIGHT TEST RELAY NO. 2 PIN C1 (REF. 33-17-03)
FROM TEST BUS NO. 3 (REF. 33-17-00)
ENGINE DRIVEN HYDRAULIC PUMP DEPRESSURIZATION
PUMP SHUT OFF WHEN ENERGIZED
ENGINE NO. 2 FIREWALL
INDICATOR LIGHTS CONTROL BOX 3317-A1 (REF. 33-17-00)
DIMMING OSCILLATOR
THROUGH TEST RELAY TO GROUND
PILOTS CAUTION AND WARNING PANEL
HYDRAULIC SYSTEM
FESC 113-240
ENGINE NO. 2 PYLON
ENGINE NO. 3 HYDRAULIC SYSTEM A FIREWALL SHUTOFF VALVE
CLOSE
OPEN
IN OPEN POSITION
CASE DRAIN THERMAL SWITCH
LOW PRESSURE WARNING HYDRAULIC PRESSURE SWITCH
FLIGHT STATION 118-204

R Engine-driven Pumps Electrical Schematic
R Figure 3 (Sheet 3)

EFFECTIVITY: ALL

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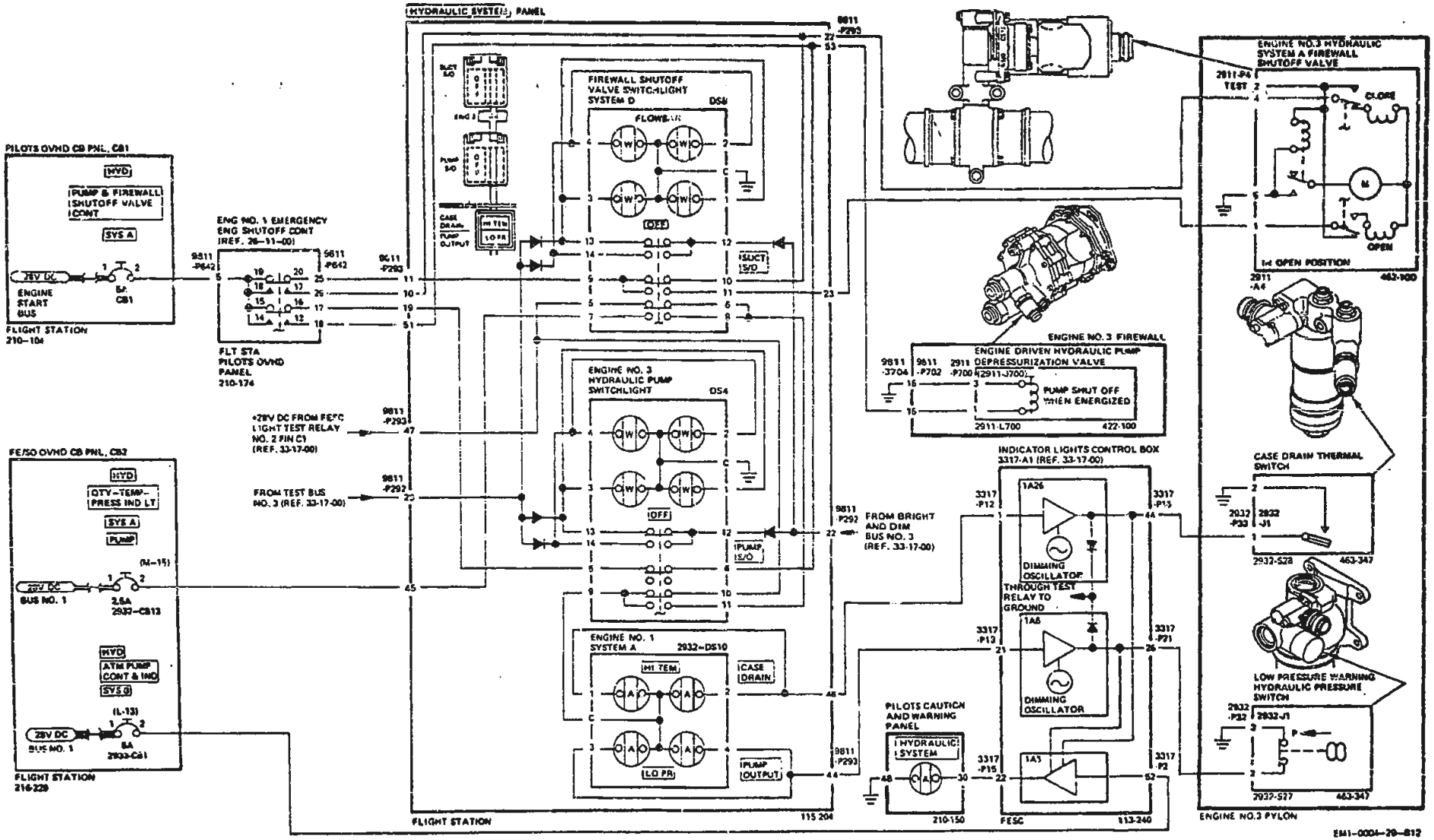
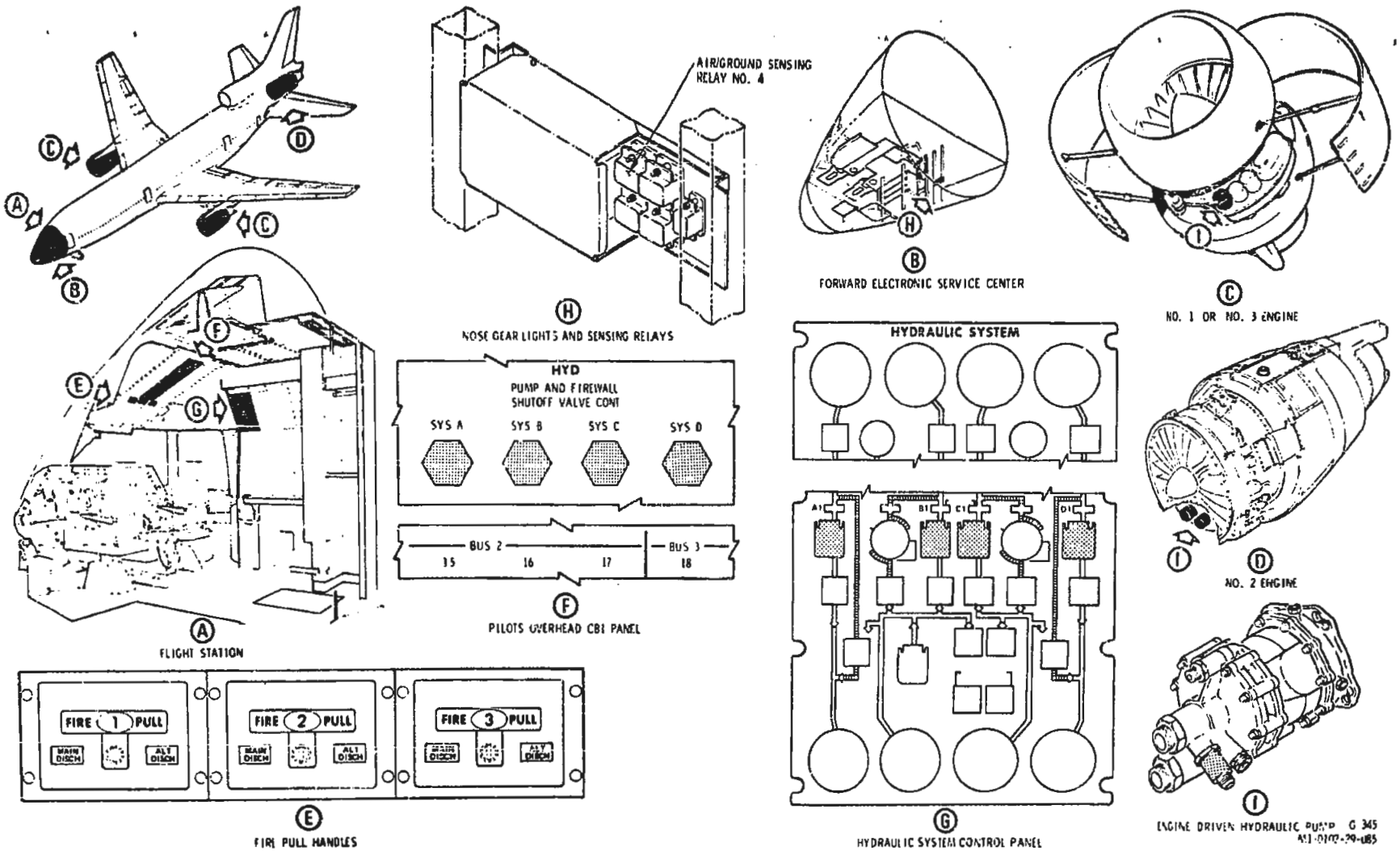


R Engine-driven Pumps Electrical Schematic
R Figure 3 (Sheet 4)

EFFECTIVITY: ALL

0018



Engine-driven Hydraulic Pump Electrical Control
Shutoff Valve Component Locator
Figure 4

R
R
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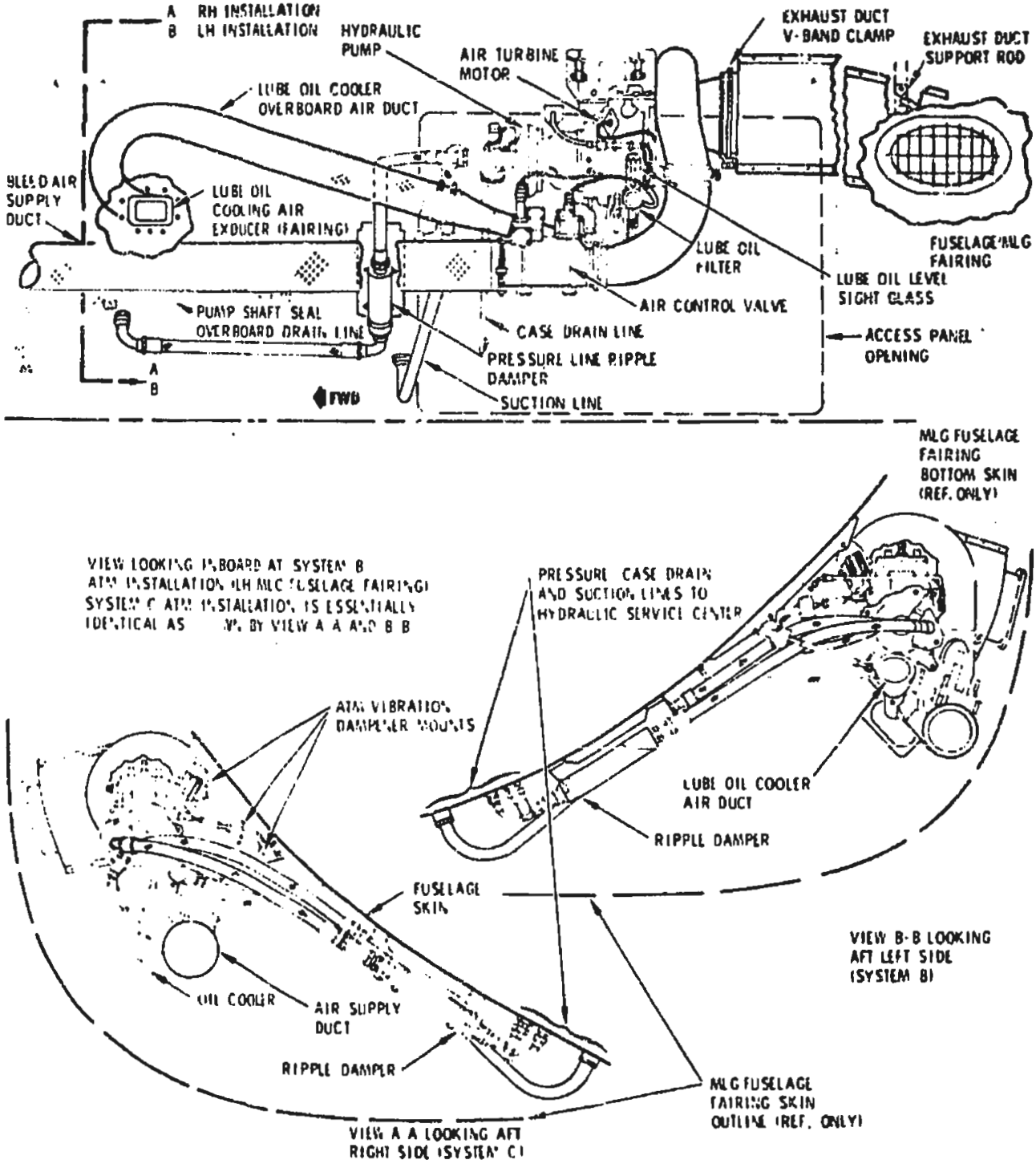
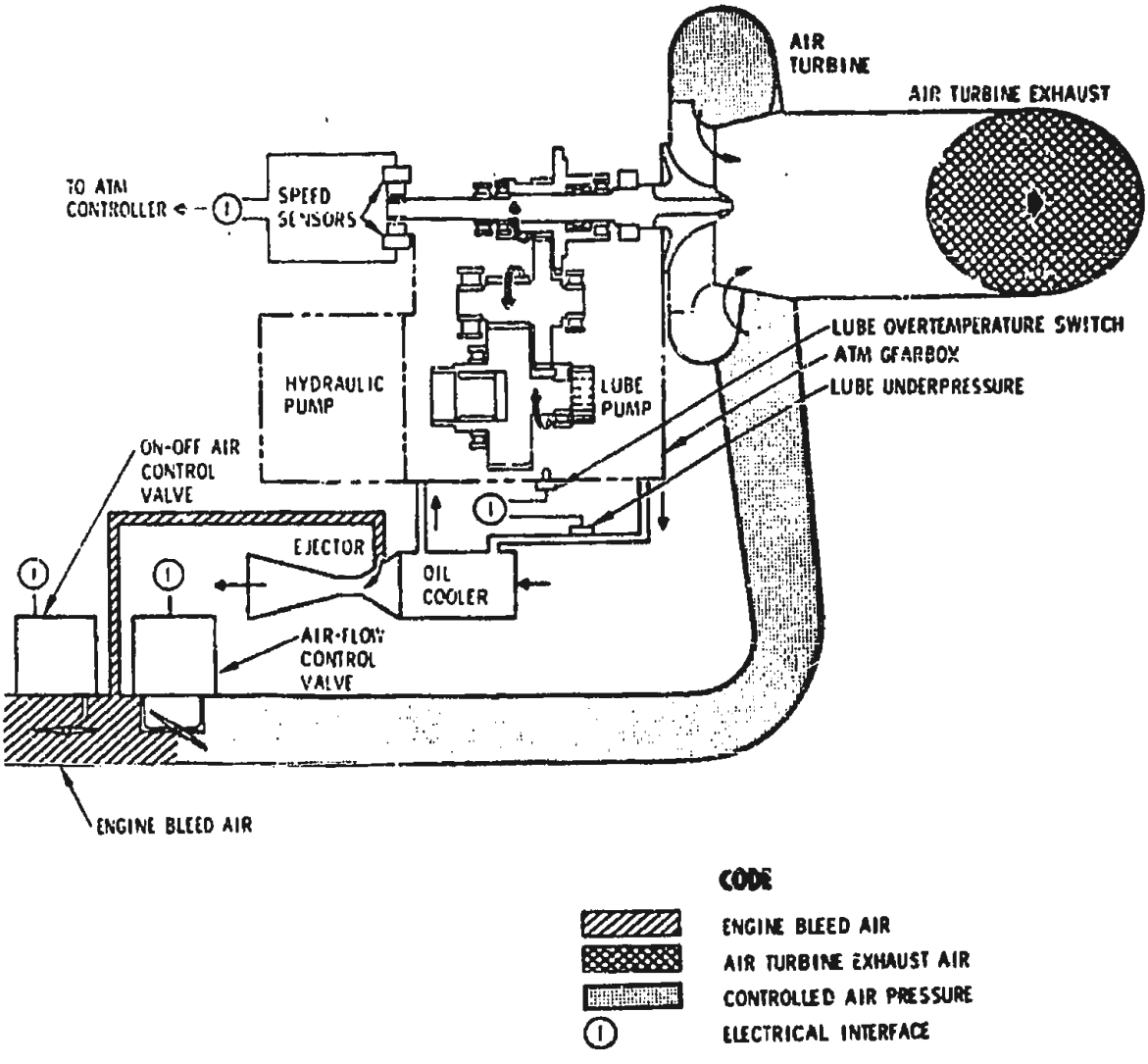

A RH INSTALLATION
B LH INSTALLATION
HYDRAULIC PUMP
AIR TURBINE MOTOR
EXHAUST DUCT V-BAND CLAMP
EXHAUST DUCT SUPPORT ROD
LUBE OIL COOLER OVERBOARD AIR DUCT
BLEED AIR SUPPLY DUCT
LUBE OIL COOLING AIR EXDUCER (FAIRING)
LUBE OIL FILTER
FUSELAGE/MLG FAIRING
LUBE OIL LEVEL SIGHT GLASS
AIR CONTROL VALVE
PUMP SHAFT SEAL OVERBOARD DRAIN LINE
CASE DRAIN LINE
ACCESS PANEL OPENING
PRESSURE LINE RIPPLE DAMPER
SUCTION LINE
FWD
MLG FUSELAGE FAIRING BOTTOM SKIN (REF. ONLY)
VIEW LOOKING INBOARD AT SYSTEM B ATM INSTALLATION (LH MLG FUSELAGE FAIRING) SYSTEM C ATM INSTALLATION IS ESSENTIALLY IDENTICAL AS ... BY VIEW A A AND B B
PRESSURE CASE DRAIN AND SUCTION LINES TO HYDRAULIC SERVICE CENTER
ATM VIBRATION DAMPENER MOUNTS
LUBE OIL COOLER AIR DUCT
RIPPLE DAMPER
FUSELAGE SKIN
VIEW B-B LOOKING AFT LEFT SIDE (SYSTEM B)
OIL COOLER
AIR SUPPLY DUCT
RIPPLE DAMPER
MLG FUSELAGE FAIRING SKIN OUTLINE (REF. ONLY)
VIEW A A LOOKING AFT RIGHT SIDE (SYSTEM C)
M1-0101-29-016

Air Turbine Motor (ATM) Hydraulic Power System
Figure 5 (Sheet 1)



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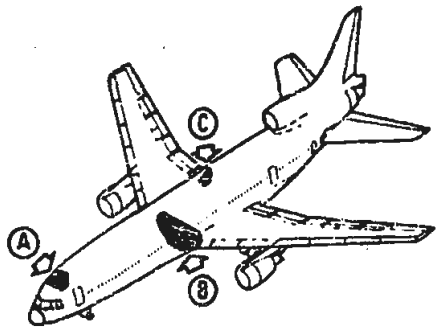
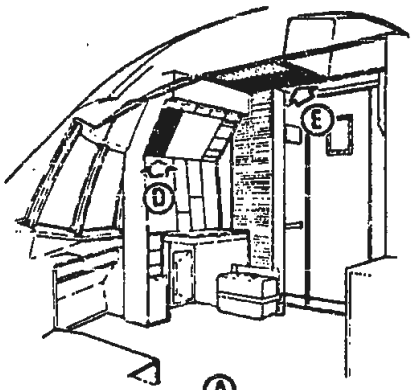
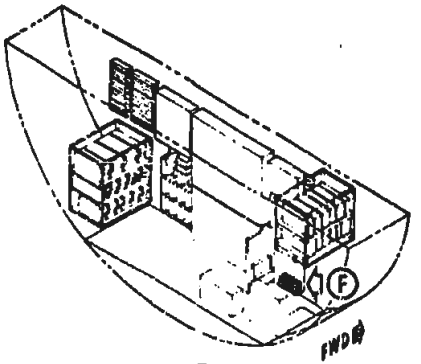
Air Turbine Motor (ATM) Hydraulic Power System
Figure 5 (Sheet 2)

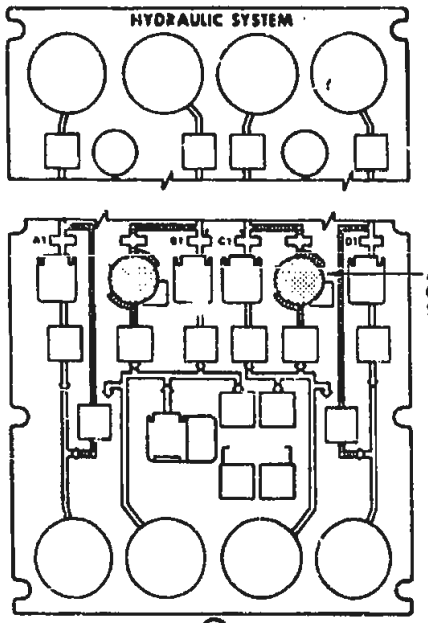




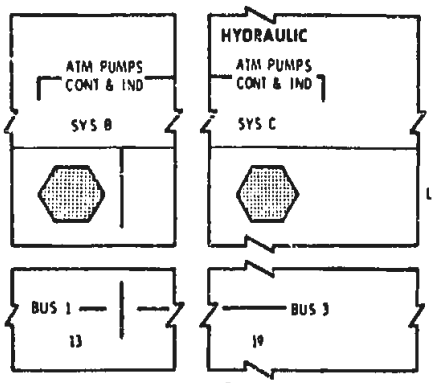
(A) FLIGHT ENGINEER/SECOND OFFICERS STATION



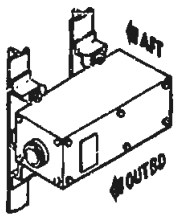
(B) MID ELECTRICAL SERVICE CENTER



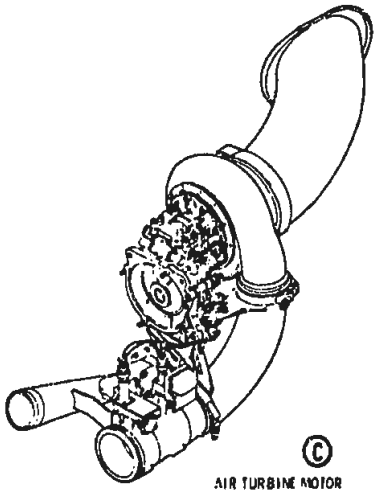
(D) HYDRAULIC SYSTEM CONTROL PANEL



(E) FLIGHT ENGINEER/SECOND OFFICERS OVHD CB2 PANEL



(F) ATM ELECTRONIC CONTROLLER



(C) AIR TURBINE MOTOR
RIGHT HAND SHOWN—LEFT HAND SIMILAR

31-0102-29-062

ATM Electrical Control Component Locator
Figure 6

R EFFECTIVITY: ALL
R
0018

in AUTO. The ATM will continue operating as long as the rotary selector switch is in the ON position.

(3) OVSP TEST Position Checkout

With the rotary switch in the OVSP TEST position, the overspeed reference logic is biased to increase the reference to 125 percent of the normal running speed. This is indicated on the ATM tachometer by the needle going into the red area and the ATM stopping (Ref. 29-33-00).

5. Electric Motor-driven Hydraulic Pump

A. Description

Two electric motor-driven hydraulic pumps are located in the hydraulic service center, zone 147, (Ref. Fig. 8). The pumps provide backup hydraulic pressure for systems B and C. Both pumps can be used in flight. The pumps are used to provide hydraulic power for the following ground operations and maintenance functions:

(1) Charging the brake accumulators before towing the airplane

(2) Pressurizing the hydraulic systems before starting engines to provide reservoir pressure and avoid cavitating the engine-driven pumps.

(3) System and component leakage checks.

NOTE: Only one component or system should be checked at a time. Flaps, slats, and landing gear should be checked using pumps of higher capacity (Ground Hydraulic Power Unit, ATM or engine-driven pumps) to preclude pressure drop problems if there are high null flow rates.

(4) System or component functional checks possible, one at a time, provided pump capacity is not exceeded.

NOTE: Do not attempt functional checks or flaps, slats or landing gear with the AC motor pump.

The electric motor cooling is provided by the pump inlet fluid. Pump output is 10.5 gpm at 1500 psi with flow demand, possibility of 3200 psi under no flow demand condition. Electrical power from the aircraft system, from the APU, or from a ground power source is required to operate the pumps.

R The system includes two 17.3 kVA motor-driven pumps, two hydraulic service center control switches, two flight station control B3 and C3 AC PUMPS ON switchlights, two remote control circuit breakers (RCCB), two remote trip-set switches, an ac pump monitor relay and two magnetic circuit breakers.

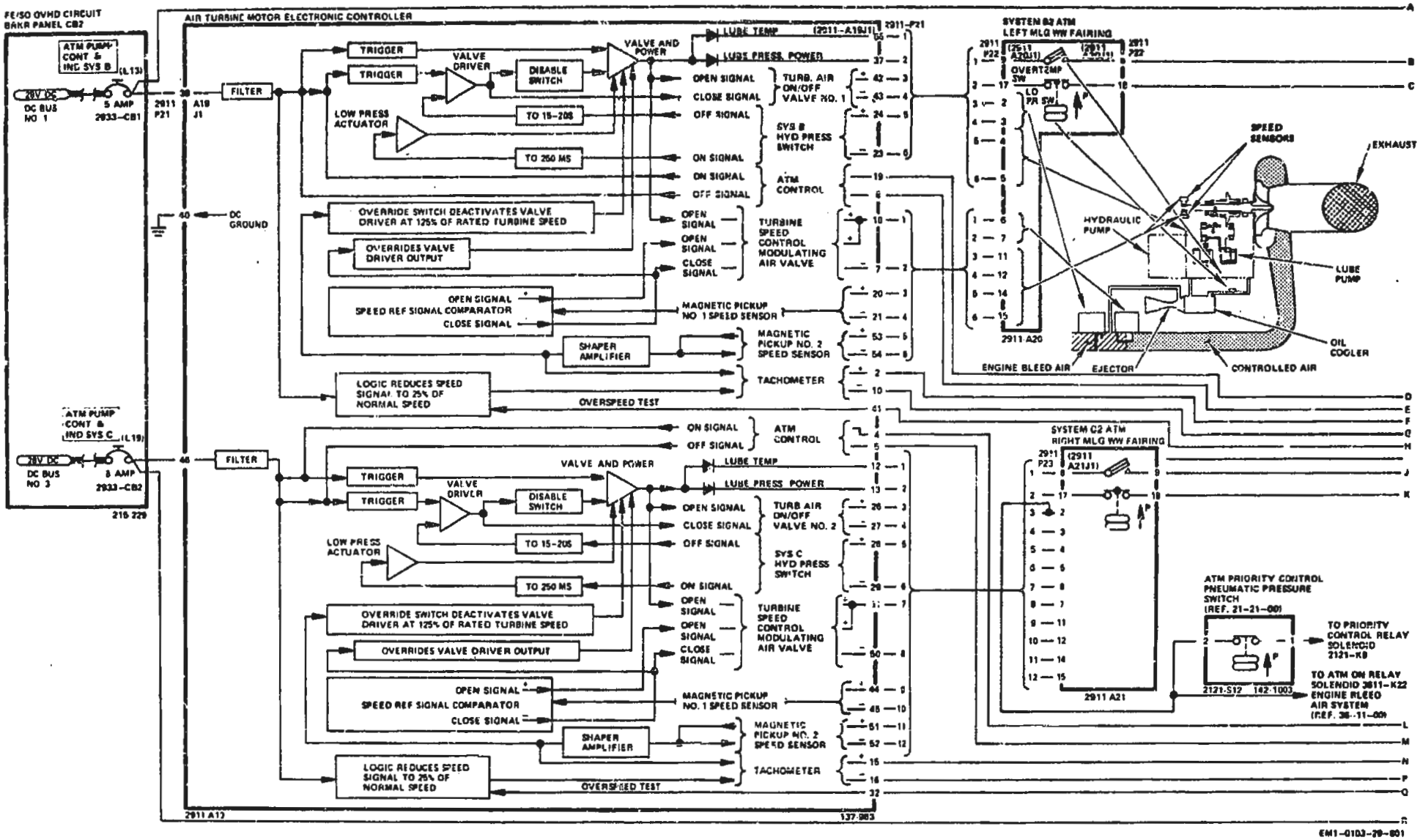
The pumps and A.C. MOTOR PUMPS switches are installed in the hydraulic service center, zone 147 (Ref. Fig. 9). The AC PUMPS ON switchlights and the trip-set switches are on the Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215. The two RCCB and the two magnetic circuit breakers are installed in the mid electrical service center, zone 137. The ac pump monitor relay is installed in the forward electronic service center, zone 112.

B. Operation

System B or C can be energized from the HYDRAULIC SERVICE PANEL or the HYDRAULIC SYSTEM control panel. Depressing the B3 AC PUMPS switchlight (ON legend illuminated) on the HYDRAULIC SYSTEM control panel, (Ref. Fig. 10) completes the dc circuit through the RCCB. Depressing the switchlight also provides dc power for the RCCB logic circuit to close the circuit breaker and to complete the ac circuit to the pump motor. The ground connection will maintain the RCCB in operation until one of the redundant protective devices opens the circuit.

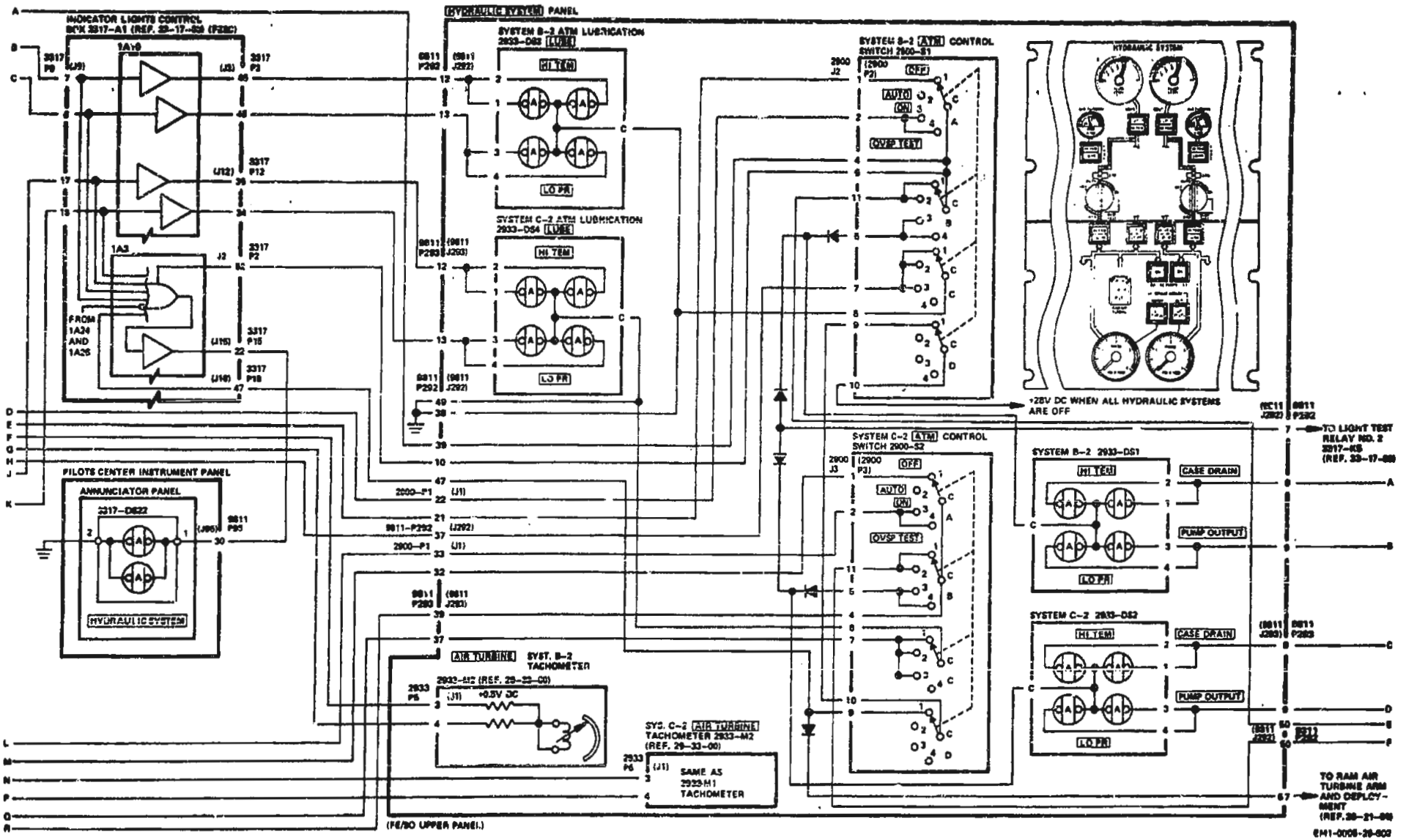
When the generator overload relay is energized, and the HYDRAULIC SERVICE PANEL switchlight and/or the HYDRAULIC SYSTEM control panel switch is on for either system, the ac pump monitor relay will remain energized to hold the RCCB ground return open until all control switches are off and the generator overload relay is deenergized. Any closed control switch will complete the ac pump monitor relay solenoid circuit, even after the generator overload relay is deenergized; therefore, all control switches must be placed in the OFF position to permit reactivation of the RCCB for pump operation.

Each electric motor-driven pump includes a thermal switch adjusted to open at 220 (±10) degrees F, and reset at 150 (±10) degrees F on aircraft 001-006 and open at 250 (±8) degrees F, and reset at 220 (±10) degrees F on aircraft 007-999. When the AC electric motor-driven pump shuts off due to a thermal switch opening, the control switch used to turn the pump on should be placed to the off position to prevent the pump coming on unexpectedly when the thermal switch cools and resets. Depending upon the ambient



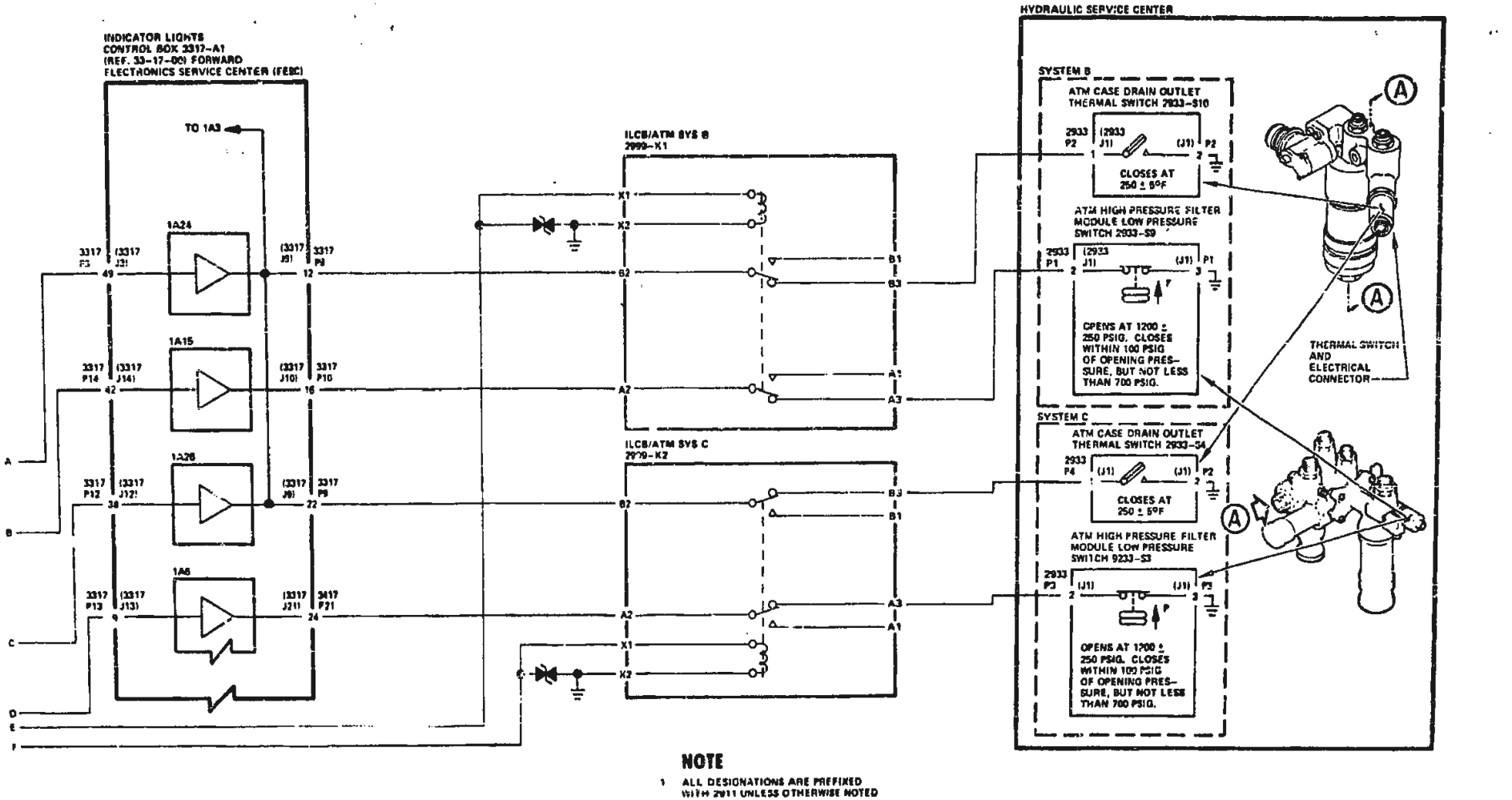
Air Turbine Motor Electrical Schematic
Figure 7 (Sheet 1)

R EFFECTIVITY: ALL
R
0018


INDICATOR LIGHTS CONTROL
HYDRAULIC SYSTEM PANEL
SYSTEM B-2 ATM LUBRICATION
SYSTEM C-2 ATM LUBRICATION
SYSTEM B-2 ATM CONTROL SWITCH 2900-S1
SYSTEM C-2 ATM CONTROL SWITCH 2900-S2
HYDRAULIC SYSTEM
+28V DC WHEN ALL HYDRAULIC SYSTEMS ARE OFF
TO LIGHT TEST RELAY NO. 2
PILOTS CENTER INSTRUMENT PANEL
ANNUNCIATOR PANEL
HYDRAULIC SYSTEM
AIR TURBINE SYST. B-2 TACHOMETER
SYS. C-2 AIR TURBINE TACHOMETER 2933-M2
SAME AS 2933-M1 TACHOMETER
SYSTEM B-2 2933-DS1
SYSTEM C-2 2933-DS2
CASE DRAIN
PUMP OUTPUT
TO RAM AIR TURBINE ARM AND DEPLOYMENT
(FE/SO UPPER PANEL)

R Air Turbine Motor Electrical Schematic
R Figure 7 (Sheet 2)

EFFECTIVITY: ALL



NOTE

1. ALL DESIGNATIONS ARE PREFIXED WITH 2911 UNLESS OTHERWISE NOTED

EM1-0103-29-821

Air Turbine Motor Electrical Schematic
Figure 7 (Sheet 3)

R EFFECTIVITY: ALL
R
0018

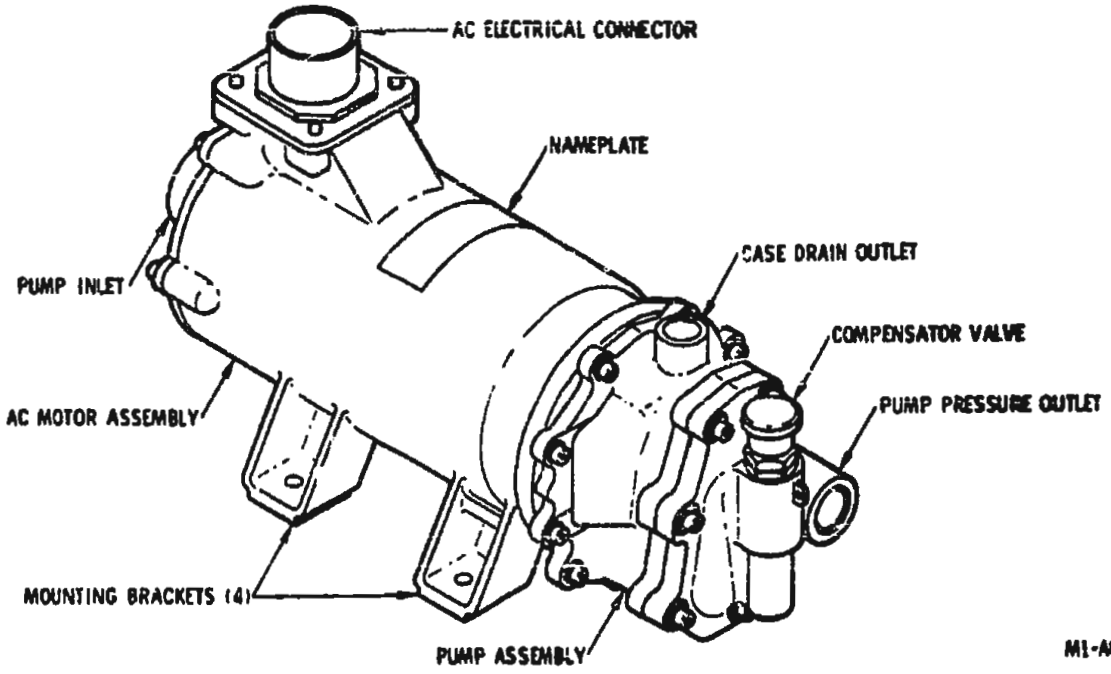
operating temperatures, a minimum of 90 seconds cooldown time is required before attempting to restart the pump.

R The magnetic circuit breakers monitor the current in the neutral lines of the associated AC Hydraulic Pump Motors. In the event of an open electrical phase external or internal to the motor or an electrical short circuit in the motor windings to ground, an increase of current in the neutral line will cause the magnetic circuit breaker to open. An auxiliary switch integral to the magnetic circuit breaker will open at the same time which will command the RCCB to open removing power from the motor. The magnetic circuit breaker can be reset at the magnetic circuit breaker panel in the MESC.

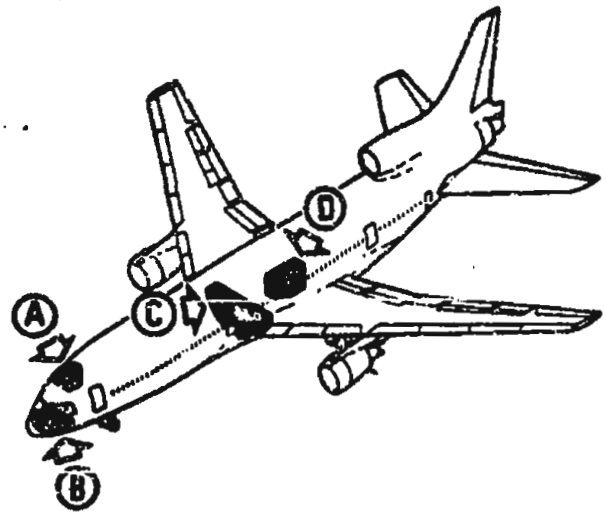
6. Power Transfer Units

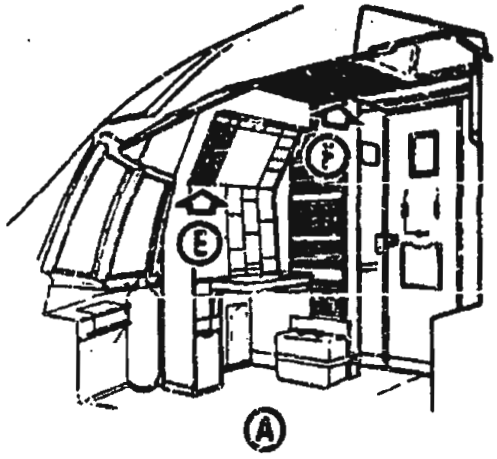
A. Description

The hydraulic power transfer units (PTU) provide the capability of generating fluid pressure in systems A and D through two pumps driven by hydraulic motors in systems B and C. The two PTU are located in the hydraulic service center, zone 147.



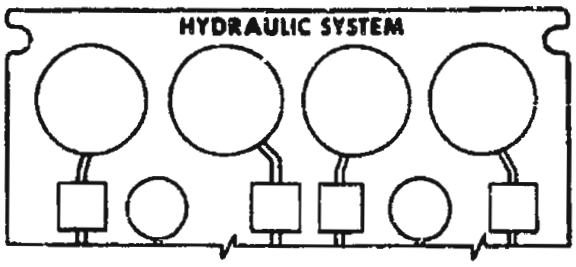
Electric Motor-driven Hydraulic Pump
Figure 8

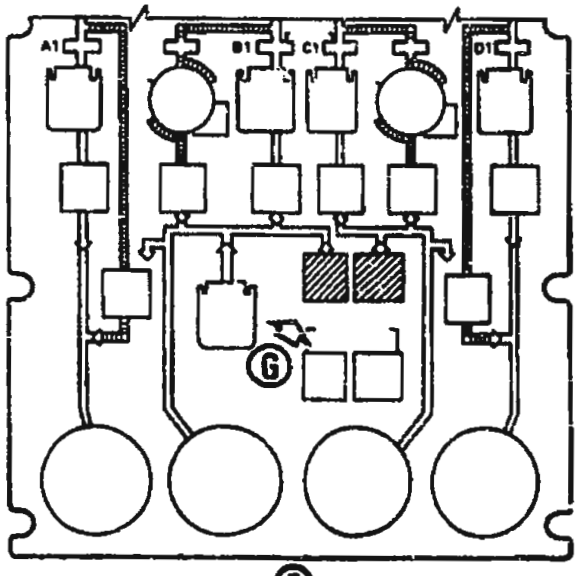




A

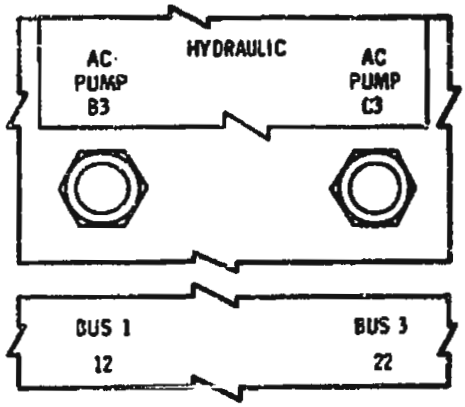
FLIGHT ENGINEER/2ND OFFICERS STATION





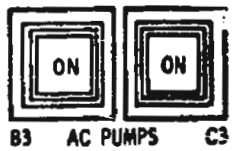
E

HYDRAULIC SYSTEM CONTROL PANEL



F

OVERHEAD CB2 PANEL

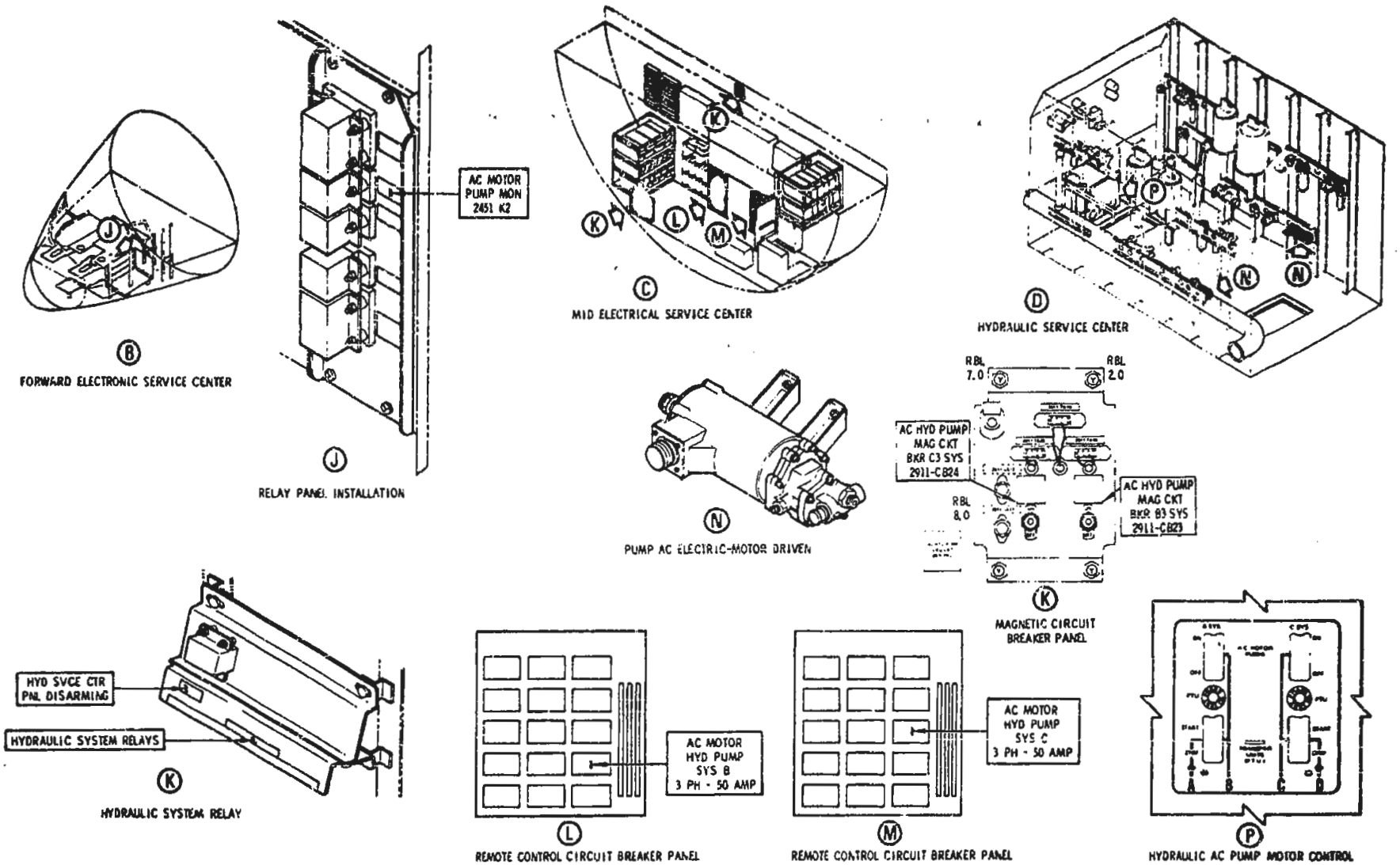


G

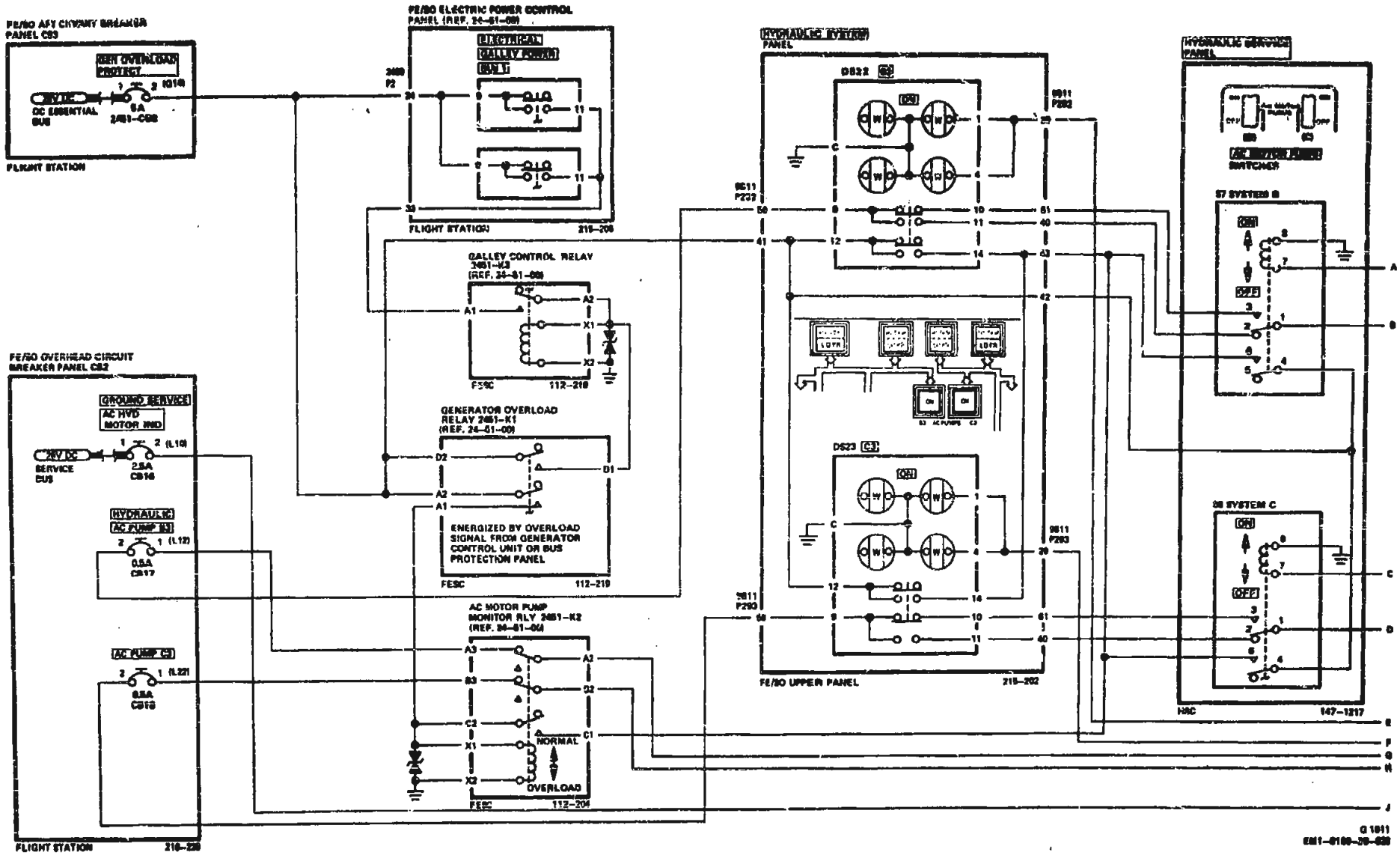
AC PUMP SWITCH

HH 5902
M1-0191-29-CB3

Electric Motor-driven Hydraulic Pump Electrical Control
Components Locator
Figure 9 (Sheet 1)

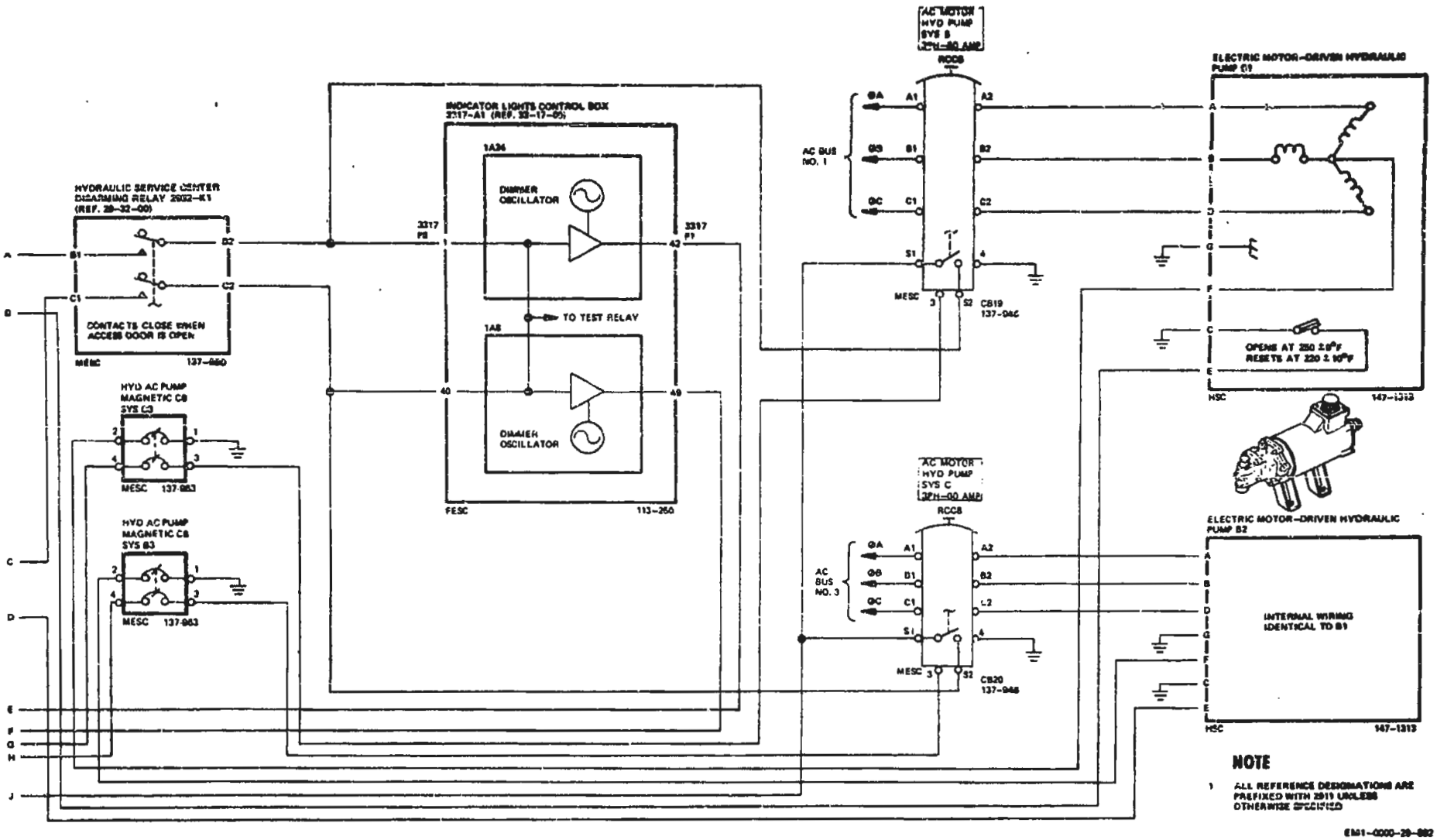


Electric Motor-driven Hydraulic Pump Electrical Control
Components Locator
Figure 9 (Sheet 2)



AC Pumps Electrical Schematic
Figure 10 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



AC Pumps Electrical Schematic
Figure 10 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

The PTU motor-pump devices (Ref. Fig. 11) are mounted on the sidewalls below the hydraulic bootstrap reservoirs. Each PTU consists of two rotating fixed-displacement, piston-type hydraulic units connected by an integrated drive shaft. The PTU are in separate housing connected to an adapter plate. Separate shaft seals and a shaft seal seepage drain port in the adapter keep the hydraulic systems completely separate. The two PTU provide hydraulic pump backup for systems A and D.

B. Operation

The PTU can be operated either from the HYDRAULIC SERVICE PANEL in the hydraulic service center, zone 147, or from the Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel in the flight station, zone 215, to perform ground maintenance or fault isolation. Hydraulic pressure to the PTU is controlled by the PTU control module, which contains a solenoid-operated shutoff valve and a flow regulator that limits the flow to the PTU to 35 gpm.

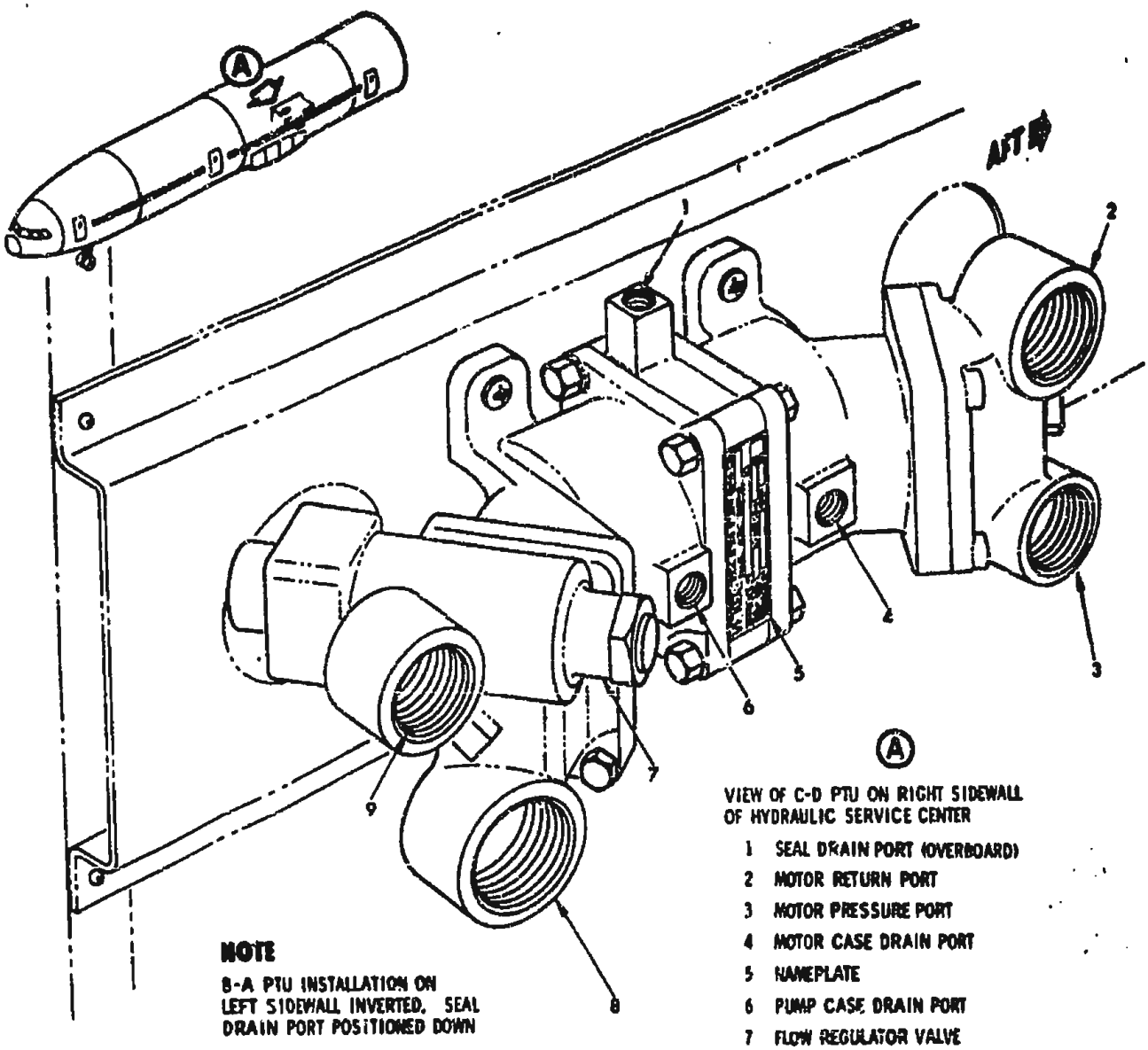
Actuating the PTU switchlight (light bar on) on the HYDRAULIC SYSTEM panel or placing the PTU START/STOP switch on the HYDRAULIC SERVICE PANEL in the START position (indicator light ON) energizes the solenoid shutoff valve in the PTU control module and directs hydraulic pressure from system B or C to the applicable PTU. When the motor section begins rotating and the pump section begins pressurizing the system, a flow regulator in the pressure outlet restricts flow until system pressure has increased sufficiently to ensure reservoir pressurization. The flow regulator then opens to allow full-flow capability. The flow regulator prevents cavitation of the pump section that could occur during high rpm and low suction line (reservoir) pressure.

Actuating the PTU switchlight, or placing the PTU START/STOP switch in the STOP position energizes the latch release solenoid on the solenoid shutoff valve. The spring-loaded poppet valve will close and stop the PTU operation. PTU indicator lights on the HYDRAULIC SERVICE PANEL (Ref. Fig. 13) indicate the last command from the START/STOP switch.

7. Power Transfer Control Module

A. Description

The power transfer unit (PTU) control module consists of a manifold with a pressure IN port and a PTU pressure OUTLET port. Two plug-in-type cartridge valves are installed in the manifold. One is a solenoid-operated shutoff valve, the



NOTE

B-A PTU INSTALLATION ON LEFT SIDEWALL INVERTED. SEAL DRAIN PORT POSITIONED DOWN

Ⓐ

VIEW OF C-D PTU ON RIGHT SIDEWALL OF HYDRAULIC SERVICE CENTER

1 SEAL DRAIN PORT (OVERBOARD)
2 MOTOR RETURN PORT
3 MOTOR PRESSURE PORT
4 MOTOR CASE DRAIN PORT
5 NAMEPLATE
6 PUMP CASE DRAIN PORT
7 FLOW REGULATOR VALVE
8 PUMP SUCTION PORT
9 PUMP PRESSURE PORT

HM 5473
M1-A00-29-018

Power Transfer Unit
Figure 11

other is a flow regulator valve that limits the flow to the PTU to 35 gpm (Ref. Fig. 12).

There are two PTU control modules, both located in the hydraulic service center, zone 147, (Ref. Fig. 13). The module mounted on the left sidewall below the B system reservoir controls the B to A PTU. The module mounted on the right sidewall below the C system reservoir controls the C to D PTU.

The controls and actuators include two PTU switchlights (light bar comes on), two magnetic latch indicator relays, two magnetic latch control relays, two power transfer control modules, two hydraulic service center PTU START/STOP switches and two indicator lights (PRESS-TO-TEST). The indicator lights control box, proximity switch card module, hydraulic service center disarming relay, and access door sensor and target provide controls for the indicator lights and power for ground operation.

The two PTU switchlights are on the Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215. The magnetic latch indicator and control relays are in the forward electronic service center, zone 113. The two solenoid shutoff cartridge valves (PTU control module) and the momentary-type PTU START/STOP switches and indicator lights are on the HYDRAULIC SERVICE PANEL, zone 147.

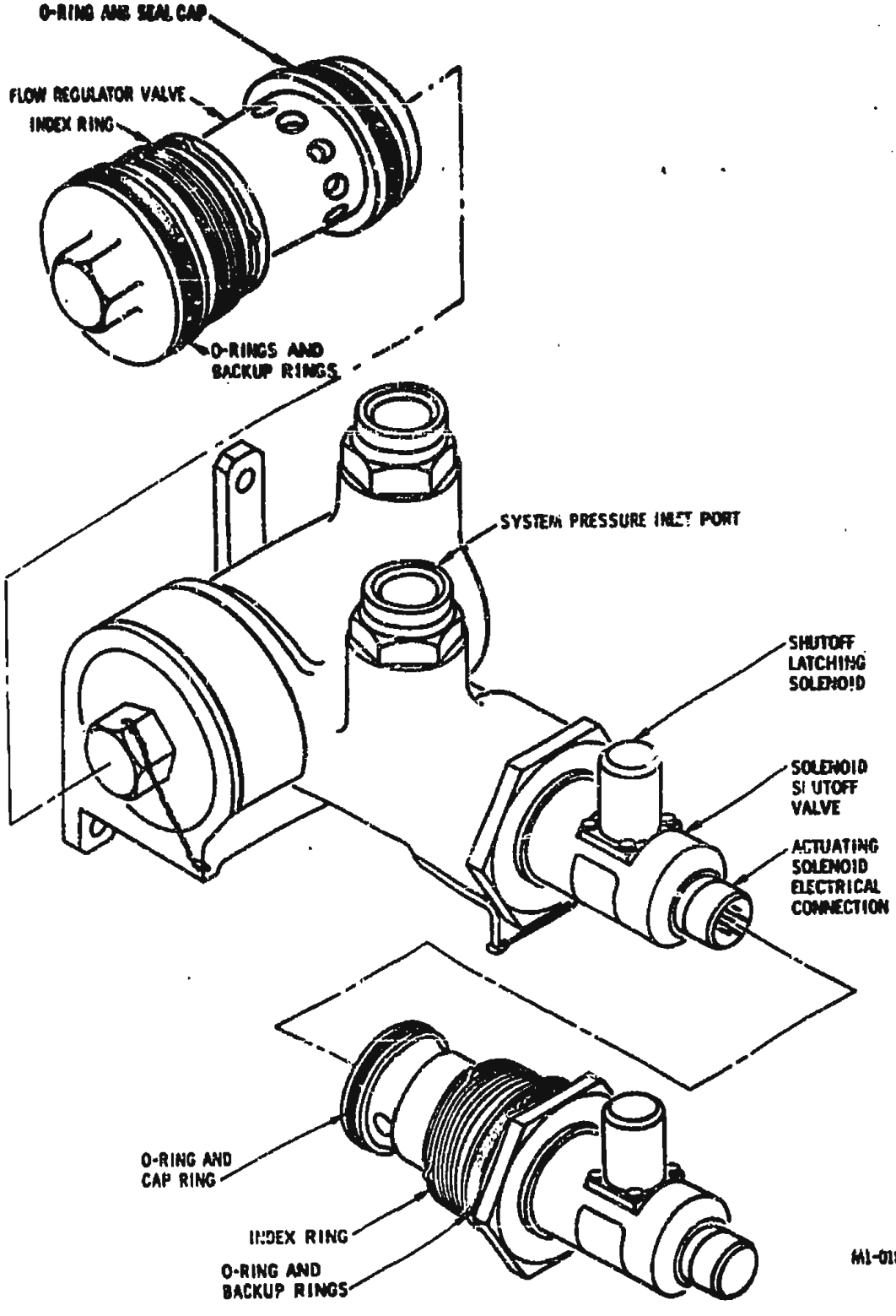
The solenoid-latching hydraulic shutoff valve is a cartridge that is installed in the chambered manifold. When the valve is installed, the manifold chambers form a part of the valve, separating the inlet and outlet sections of the valve. The valve body has external threads for mounting. A coded ring, located near the mounting threads, acts as an indexing guide for installing the valve in its proper location in the hydraulic system.

The solenoid assembly, which contains two independent solenoids is screwed into the flange end of the valve body. The solenoid assembly has a 4-pin electrical connector.

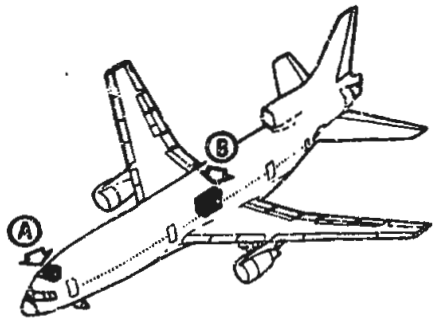
The hydraulic flow regulator valve (Ref. Fig. 12) is a cartridge-type unit designed to control the flow of hydraulic fluid. The valve consists of a spring-loaded sleeve ported piston that contains a fixed orifice. The cartridge valve contains an indexing ring to ensure installation of the valve in the correct manifold cavity.

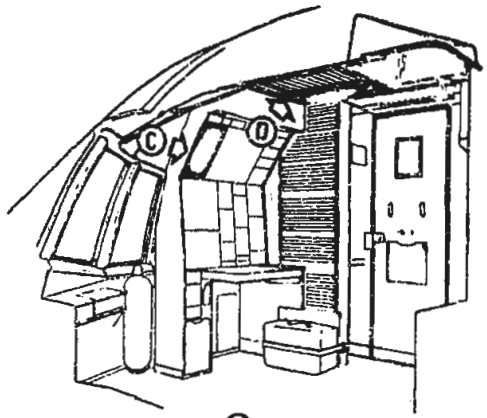
B. Operation

Either system (B to A or C to D PTU) is energized (Ref. Fig. 14) by depressing the PTU switchlight (light bar comes on)

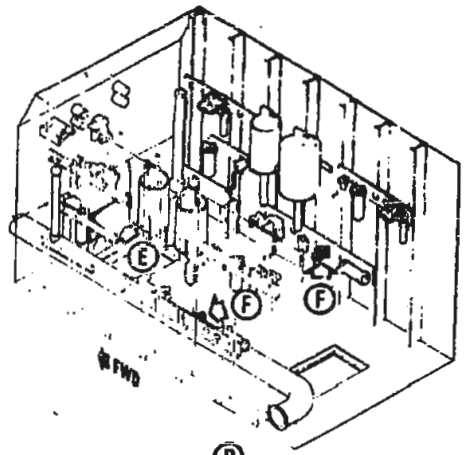


Power Transfer Unit Control Module
Figure 12

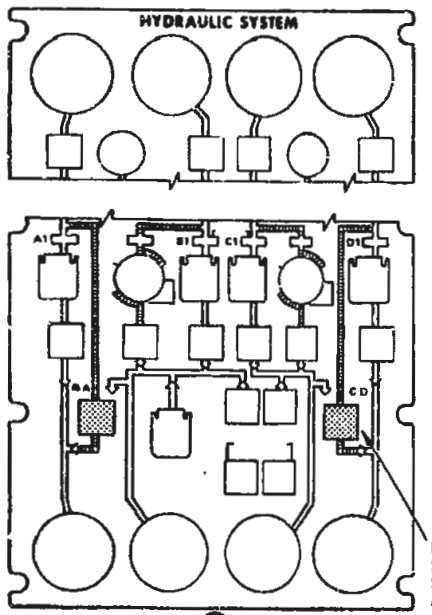




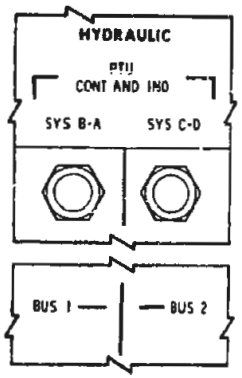
Ⓐ FLIGHT ENGINEER/SECOND OFFICERS STATION



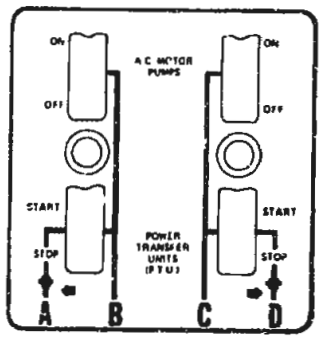
Ⓑ HYDRAULIC SERVICE CENTER



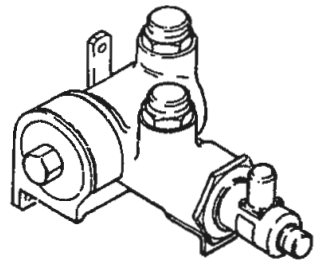
Ⓒ HYDRAULIC SYSTEM CONTROL PANEL



Ⓓ FLIGHT ENGINEER/SECOND OFFICERS OVERHEAD CB2 PANEL



Ⓔ HYDRAULIC SYSTEM SERVICING PANEL PTU CONTROL SWITCHES



Ⓕ SOLENOID SHUTOFF CARTRIDGE VALVE

G346
M1-0101-29-084

Power Transfer Units Electrical Control Components Locator
Figure 13

on the HYDRAULIC SYSTEM control panel, or placing the momentary type switch on the HYDRAULIC SERVICE PANEL (Ref. Fig. 13) in the START position. The 28V dc power is then applied across the ON solenoid of the magnetic latch indicator relay to illuminate the indicator light and energize the main solenoid of the cartridge valve. Depressing the PTU switchlight, or by placing the momentary switch in the STOP position will momentarily energize the OFF solenoid to open the light circuit and momentarily energize the latch release solenoid to close the valve.

The magnetic latch indicator and control relays, each of which contains two solenoids, will hold in either position until the opposite solenoid is energized. The solenoid shutoff valve is a mechanical latching valve. After the main solenoid is momentarily energized, a spring-loaded latch will drop into a keyway to hold the valve open. The latch release solenoid, when energized, will pull the key from the latching keyway to release and close the spring-loaded valve.

The flow regulator valve, also installed in the PTU control module, limits the flow to the PTU motor section to a maximum of 35 gpm. A spring-loaded sleeve ported piston with a fixed orifice is displaced by a pressure differential across the fixed orifice. When the flow reaches 35 gpm, the ports in the piston sleeve restrict any further increase in the flow rate.

8. Hydraulic Power System Filters

A. Description and Operation

Fluid in each system is filtered continuously by multiple filters that keep the fluid and the plumbing system free of contamination. Filtering is accomplished by high-pressure and case drain filters located near the hydraulic power sources, and by return line filters upstream of the reservoirs, zone 147 (Ref. Fig. 15). Filters are also provided at each servo actuator pressure inlet.

Fluid filtration in microns (absolute) for the different filters is as follows: high-pressure and case drain filters 15 microns, return line filters 3 microns, servo actuators 25 microns.

All filters, except servo actuator filters, have temperature-compensated differential pressure (clogged-element) mechanical pop-up warning indicators which also actuate a switch lighting the applicable CLOGGED FILTER WARNING LIGHTS on the HYDRAULIC SERVICE PANEL in the

hydraulic service center, zone 147. When a CLOGGED FILTER WARNING LIGHT is noted on the panel, all filter assemblies in the indicated area must be inspected for extended pop-up indicators. The filter element must be replaced (Ref. 29-11-19, 29-11-22, 29-11-28). If metal particles are found in the case drain filters, the associated pump should also be replaced and the pressure and return filters examined for possible contamination. After filter element replacement the pop-up indicator must be reset (depressed).

All filter elements in the hydraulic power system are of the replaceable, noncleanable type. The servo actuator filters are recleanable metal filters.

9. High-pressure Filters

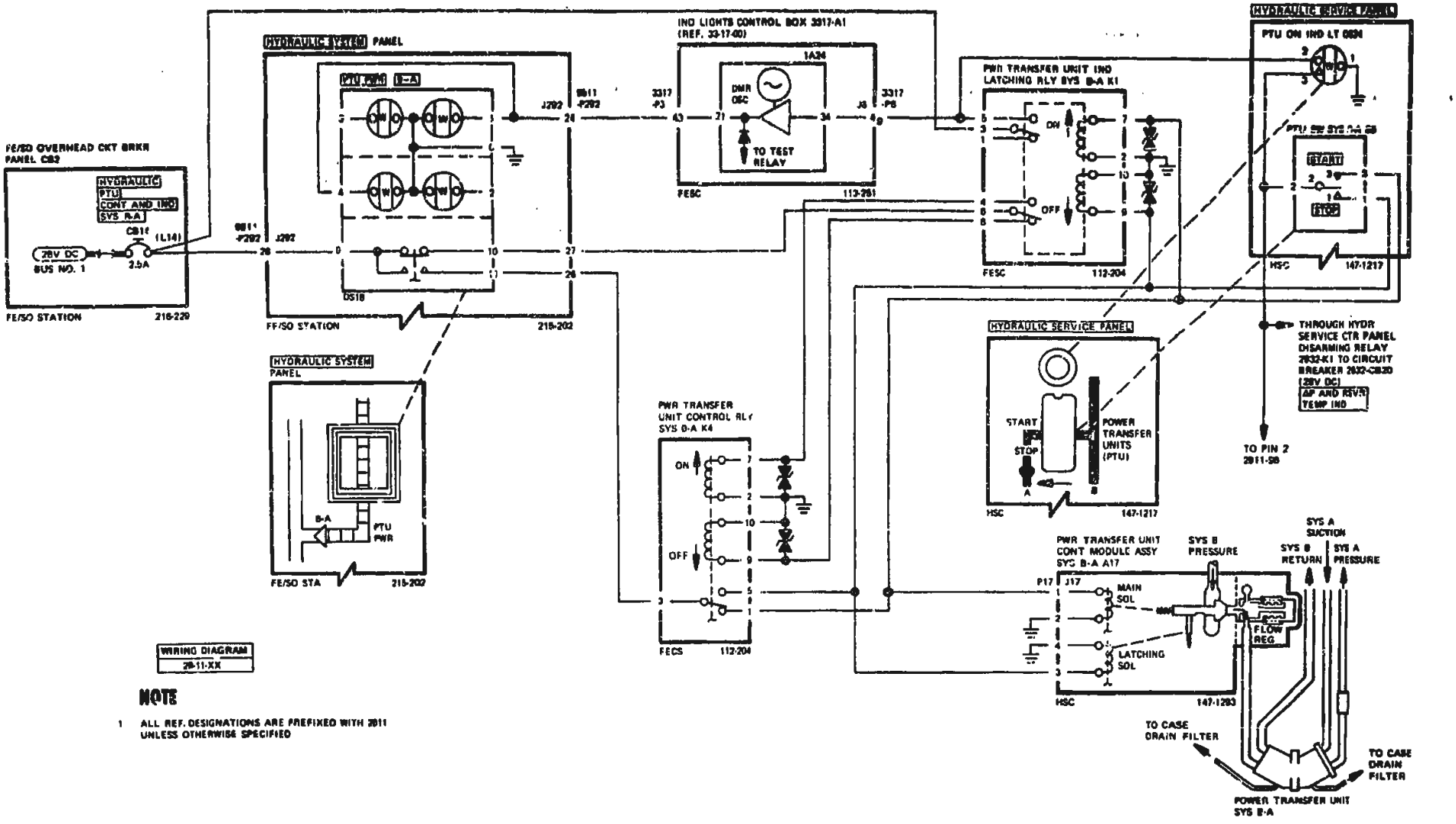
A. Description and Operation

All high-pressure fluid is filtered before entering the hydraulic systems. Two types of filter assemblies are used: in-line and plug-in filter modules. An in-line filter housing assembly (Ref. Fig.16) is located near each of the engine-driven pumps: one in each wing pylon, zones 453 and 463, and two in the afterbody mid/lower section right and left sides of zone 439.

All of the high-pressure filter housings are machined from aluminum alloy 2024T4 anodized. An integral check valve prevents reverse flow through the filter when the primary pressure source is inoperative. A diaphragm check valve, actuated by the filter bowl and element, prevents loss of fluid during filter element removal. Each filter housing has a low-pressure warning switch for system low-pressure caution light indication. The filter units do not have bypass valves.

A plug-in-type filter housing assembly is installed in each of the four high-pressure filter modules located in the hydraulic service center, zone 147, (Ref. Fig. 17). Two of the filter modules filter fluid from the AC electric motor driven pumps and the air turbine motor (ATM) driven hydraulic pumps (systems B and C). The remaining two filter modules filter fluid from the pump section of the power transfer units (PTU).

The high-pressure filter modules also contain the system pressure relief and priority cartridge valves, the low-pressure warning switches for systems B and C (ATM pumps), and the system pressure transmitters. The filter modules are mounted on the sidewalls of the hydraulic



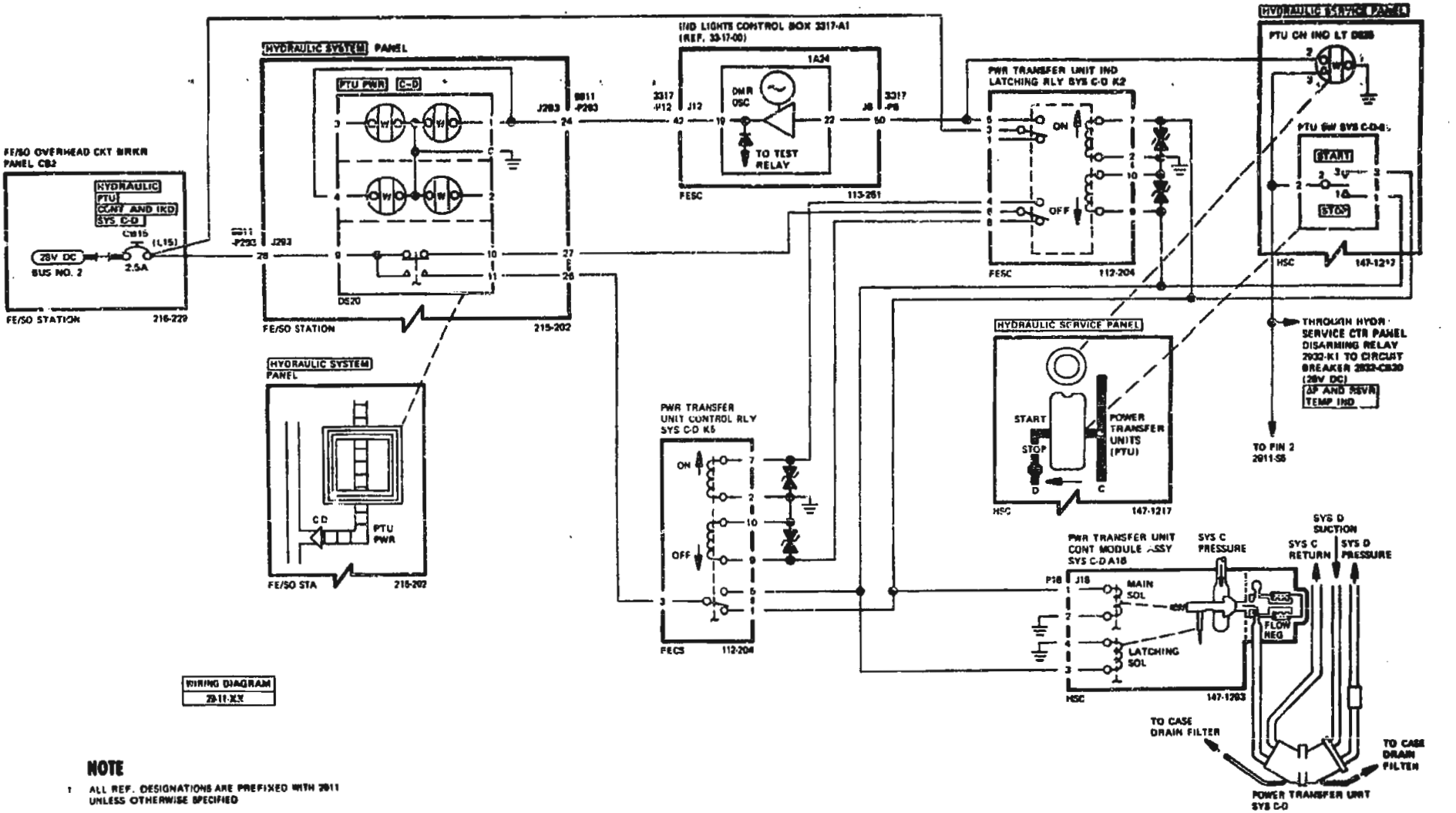
NOTE

1 ALL REF. DESIGNATIONS ARE PREFIXED WITH 2811 UNLESS OTHERWISE SPECIFIED

EM1-0102-28-010

Power Transfer Units Electrical Schematic
Figure 14 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



NOTE

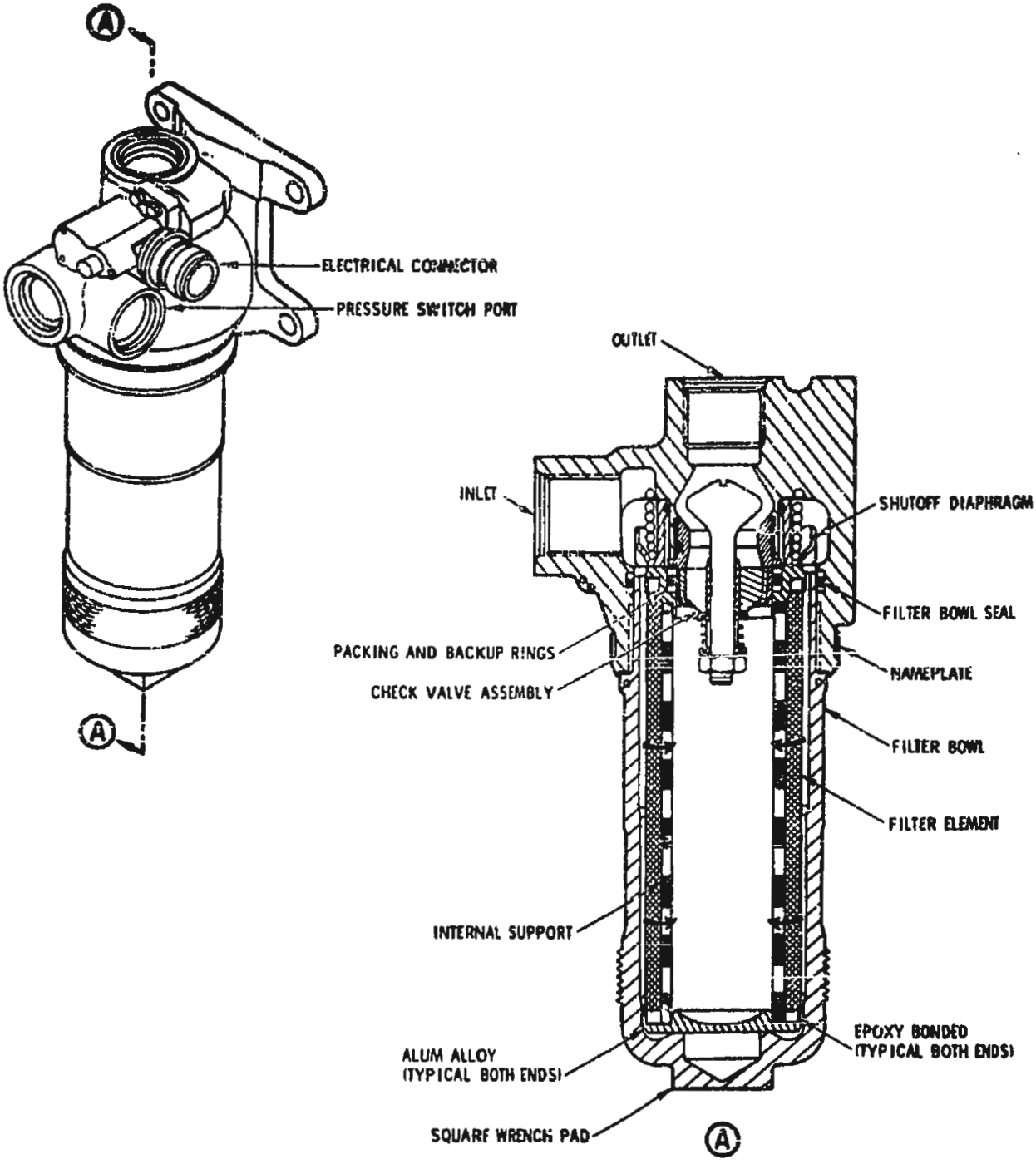
1 ALL REF. DESIGNATIONS ARE PREFIXED WITH 2911 UNLESS OTHERWISE SPECIFIED

Power Transfer Units Electrical Schematic
Figure 14 (Sheet 2)

FILTER DESCRIPTION	AREA	PYLONS		AFT FUS		HYD SVCE CTR	
		LH	RH	LH	RH	LH	RH
	ZONE	453	463	439	439	147	147
HIGH PRESSURE, ENGINE DRIVEN PUMPS (IN-LINE TYPE)		A	D	B	C		
HIGH PRESSURE, ATM, AC PUMPS (PLUG-IN FILTER MODULE)						B	C
HIGH PRESSURE, PTU PUMP SECTION (PLUG-IN FILTER MODULE)						A	D
CASE DRAIN, ENGINE DRIVEN PUMPS (SINGLE BOWL)		A	D	B	C		
CASE DRAIN ATM PUMPS (SINGLE BOWL)						B	C
CASE DRAIN, AC PUMPS (DUAL BOWL),						B	C
CASE DRAIN, PTU, MOTOR SECTION (DUAL BOWL)						B	C
CASE DRAIN, PTU, PUMP SECTION (SINGLE BOWL)						A	D
RETURN LINE (IN-LINE TYPE)						A,B	C,D

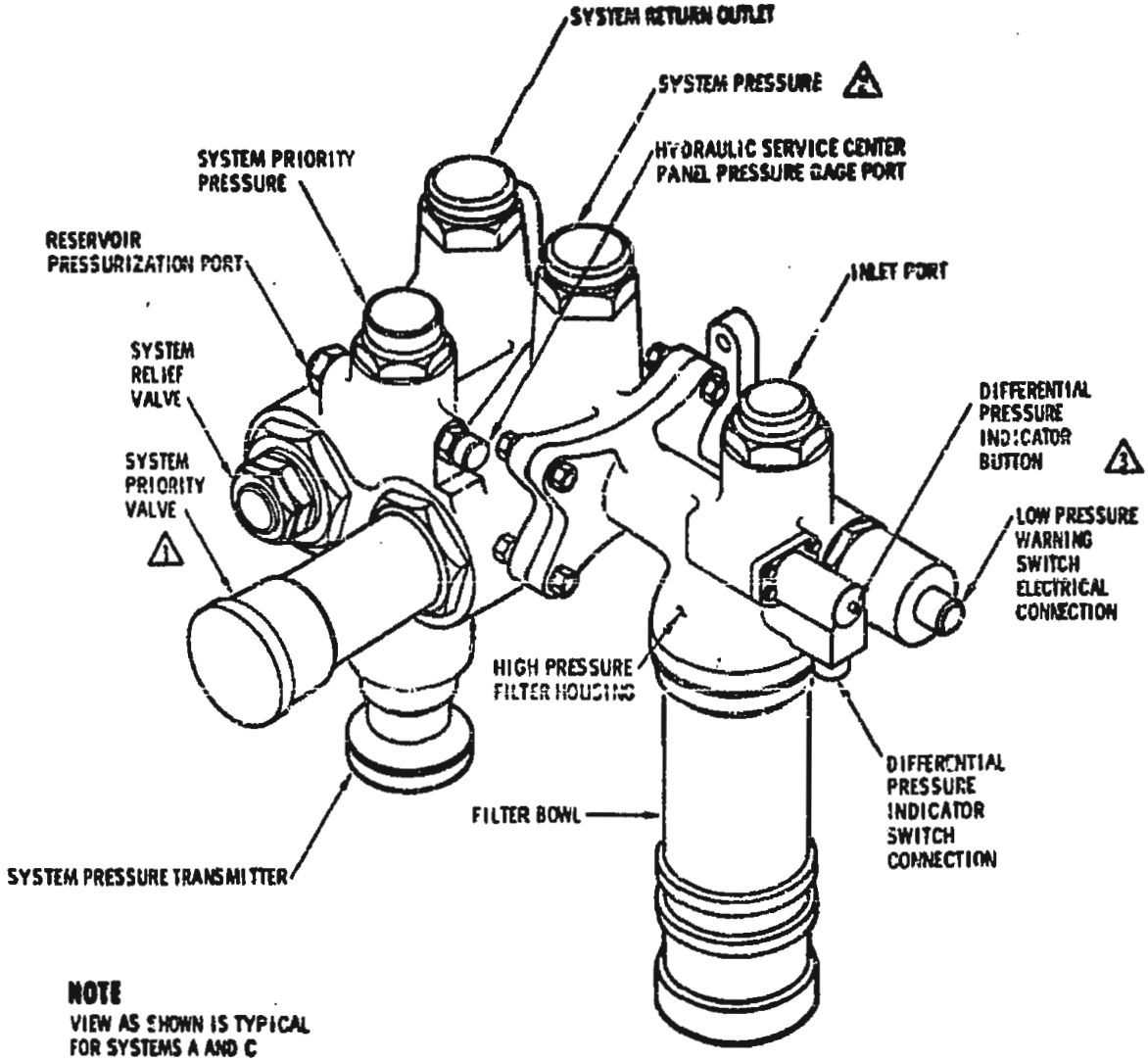
M1-0101-29-034

Hydraulic Filter Location Chart
Figure 15



HH 5060
M1-A00-29-022

High-pressure Filter Housing Assembly (Engine-driven Pump)
Figure 16



NOTE
VIEW AS SHOWN IS TYPICAL FOR SYSTEMS A AND C

1. PRIORITY VALVE REMOVED AND CAVITY PLUG INSTALLED FOR SYSTEMS B AND D
2. PORT CAPPED ON MODULES USED IN SYSTEMS B AND D
3. INDICATOR BUTTON EXTENDS 3/16 INCH WHEN ACTUATED

HH 4599
M1-A00-29-000

High-pressure Filter Module
Figure 17

service center (systems A and B on the left side, and systems C and D on the right side).

10. Return Filter Module

A. Description and Operation

A return filter module is provided for each of the four hydraulic systems to filter the return fluid before it enters the reservoir. The filter modules are located in the hydraulic service center, zone 147, next to the respective system reservoir.

The filter (Ref. Fig. 18) is a full-flow-type with a replaceable, noncleanable filter element that filters up to 3 microns (absolute). The filter and element have a flow capacity of 80 gpm. A differential pressure indicator (red button) and a pressure switch with a circuit to the HYDRAULIC SERVICE PANEL, zone 147, provide clogged-filter warning light indication when the differential pressure reaches 115 ±15 psi. [A bypass valve will open if the filter becomes clogged and the differential pressure across the element exceeds 250 psid.]

The filter housing incorporates a fluid sampling valve and port to enable hydraulic fluid samples to be obtained for fluid condition analysis. A port on the filter housing is connected to the reservoir fill quick disconnect on the HYDRAULIC SERVICE PANEL. All replenished fluid is routed through the return filter before going to the reservoir.

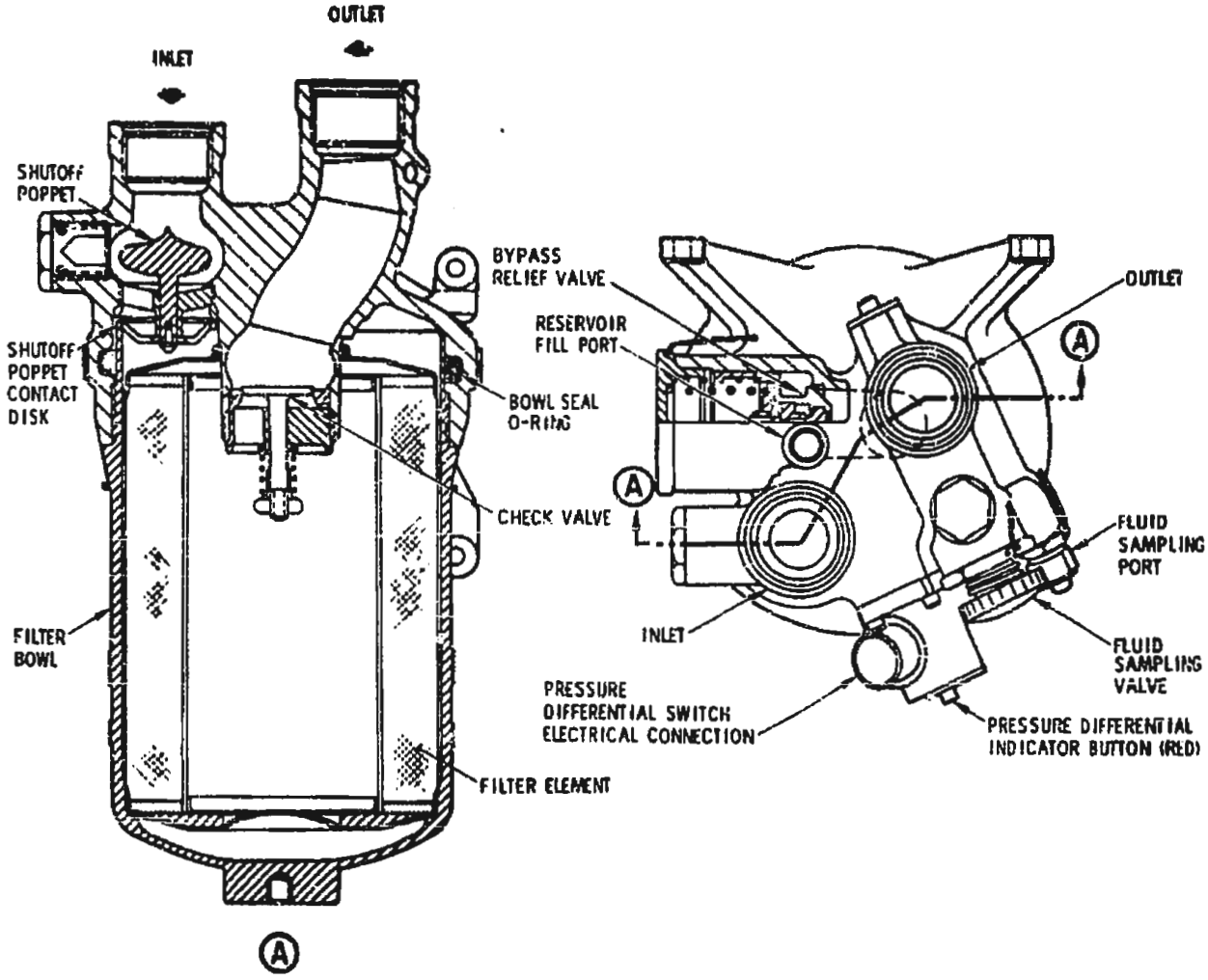
A shutoff poppet valve, actuated by the filter bowl and element, prevents loss of fluid during filter element removal. It is imperative that the filter bowl/element is fully inserted (no threads showing) to ensure that the shutoff poppet valve is fully opened.

NOTE: On aircraft modified by Service Bulletin 29-069, the shutoff poppet valve assembly is removed. This will preclude the possibility of fluid flow blockage which can result from an improperly installed filter.

11. Case Drain Filter Modules

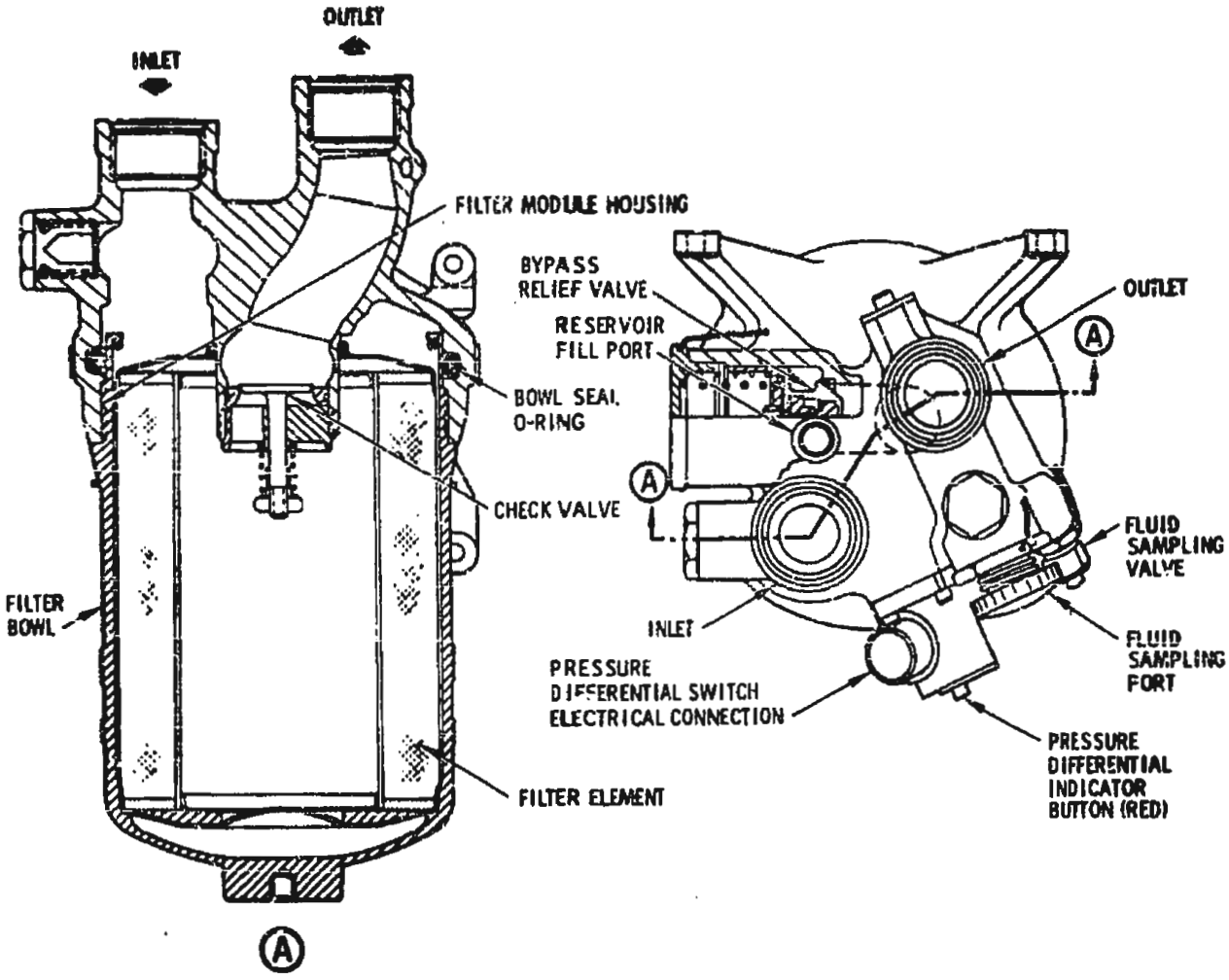
A. Description and Operation

Case drain filters are used to filter the case drain fluid from the hydraulic pumps and the power transfer units (PTU). The case drain filters entrap contaminants coming from the



HH 4639
M1-A00-29-011

Return Filter Module
Figure 18



MI-0000-29-391

Return Filter Module
Figure 18

pumps and hydraulic motors. The filters prevent contamination of the return system plumbing and provide a means of fault-isolating a malfunctioning pump by inspection of the case drain filter element.

The hydraulic system uses two types of case drain filter modules: dual bowl (Ref. Fig. 19) and single bowl (Ref. Fig. 20).

Each dual-bowl filter module filters case drain fluid from the electric motor-driven pump and from the motor section of the PTU for systems B and C. A single-bowl module is provided for each engine-driven and ATM-driven hydraulic pump. The pump section case drain fluid of each PTU is filtered by a single-bowl module (Ref. Fig. 15 for filter locations).

Each filter module contains a differential pressure switch assembly with a button indicator. The engine- and ATM-driven pump case drain filters contain a thermal switch to warn of excessive case drain fluid temperature.

12. Hydraulic Firewall Shutoff Valve

A. Description

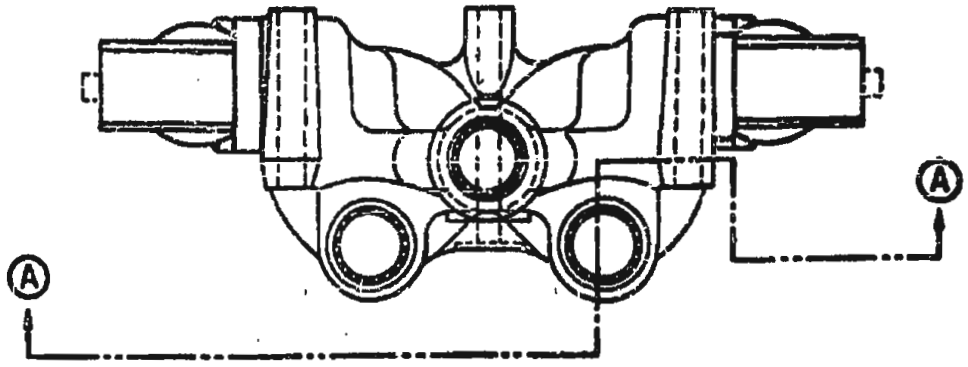
The firewall shutoff valve system isolates the hydraulic system suction lines from the engine-driven hydraulic pumps.

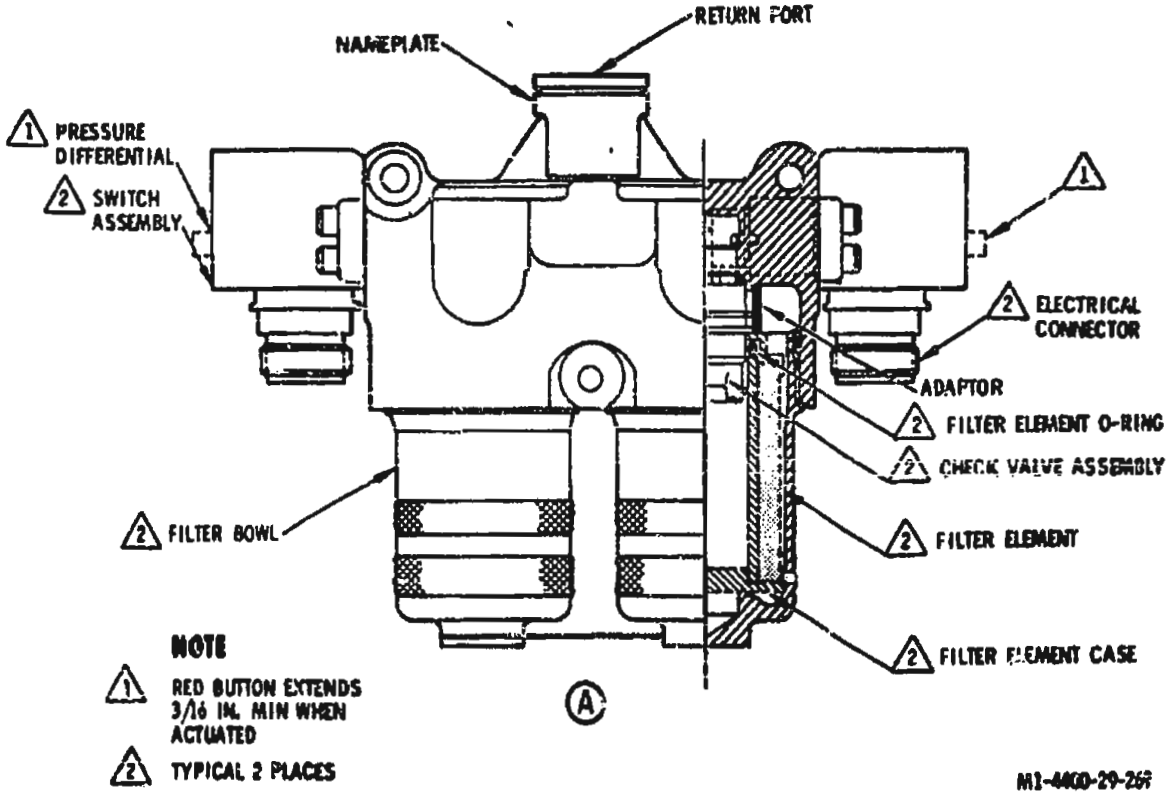
The system includes four guarded latching SUCTION S/O switchlights with integral flow line (light bar) and OFF lights on the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and four 28V dc motor-operated sliding gate valves (Ref. Fig. 21). Three emergency engine shutdown (FIRE-PULL) handles on the pilots eyebrow panel, zone 210, control the hydraulic firewall shutoff valves. The valves also have a manual operation lever that indicates OPEN or CLOSED (Ref. Fig. 22).

System A shutoff valve is installed in engine No. 1 pylon, zone 453. Systems B and C shutoff valves are installed in the afterbody mid/lower section for engine No. 2, zone 317. System D shutoff valve is installed in engine No. 3 pylon, zone 463.

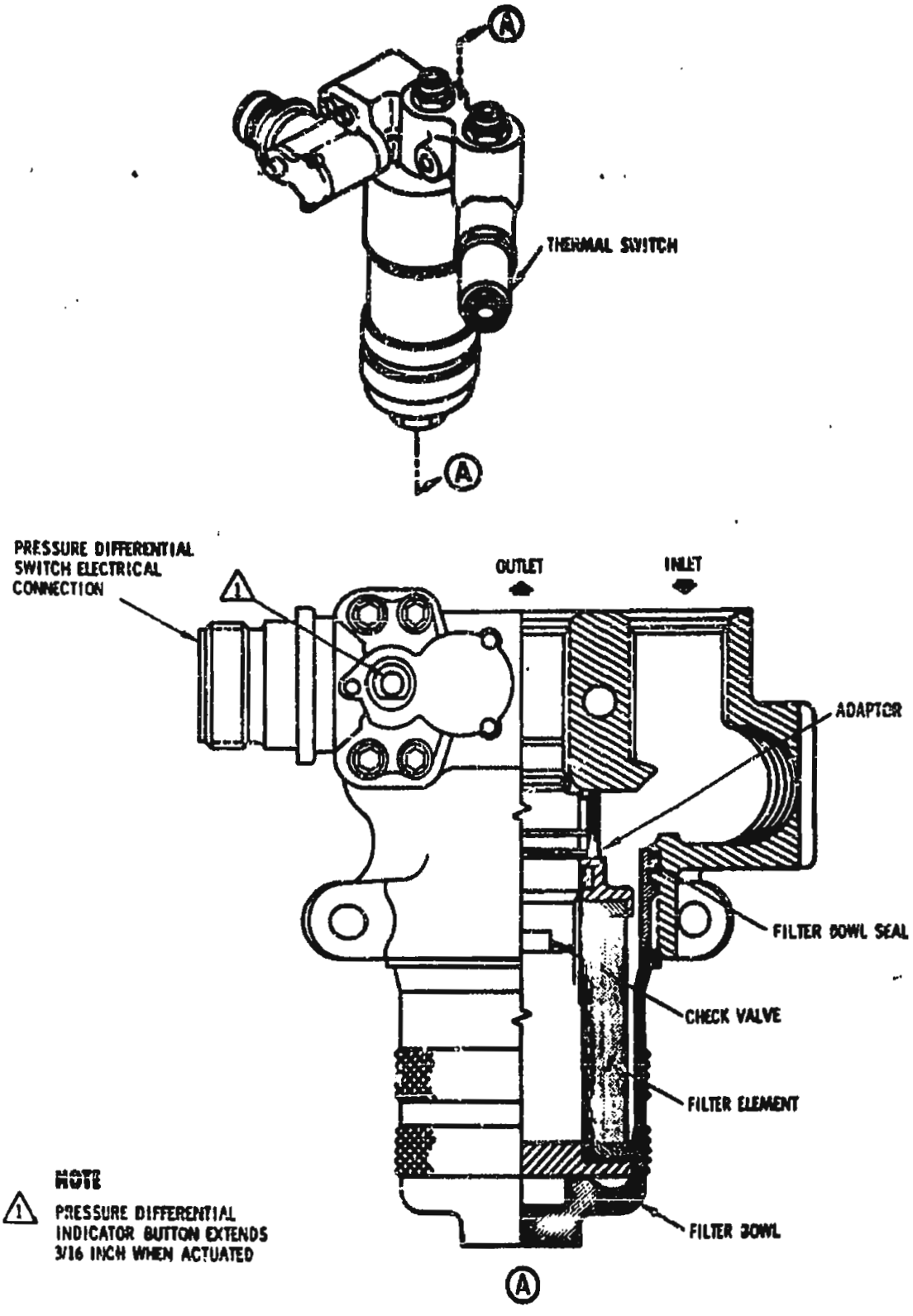
B. Operation

Each valve (Ref. Fig. 3) includes a motor, a relay, and two limit switches. With the firewall shutoff valve switchlight (SUCTION S/O) in the off position or the FIRE-PULL handle in the OFF position (pushed in), the motor





Case Drain Filter Module, Dual Bowl
Figure 19



Case Drain Filter Module, Single Bowl
Figure 20

will be energized through the open position limit switch and complete the circuit to ground through the deenergized relay armature. The motor will stop when the valve mechanically closes the open position limit switch at its extreme end of travel. An external actuating lever enables manual closing for ground operation with electrical power removed.

When the FIRE PULL handle is pulled, fluid flow is shut off, and the engine-driven hydraulic pump is depressurized. The switch flowbars, (firewall shutoff valve and hydraulic pump switch lights) however, remain on until the respective engine pump switches are turned off.

13. Hydraulic System Pressure Relief Valves

A. Description

System high-pressure, cartridge-type relief valves are provided for each of the four hydraulic systems. A relief valve is installed in each of the four high-pressure filter modules located in the hydraulic service center, zone 147, (Ref. Fig.23).

The valves have index rings to prevent a valve from being installed in the wrong cavity of the pressure filter module.

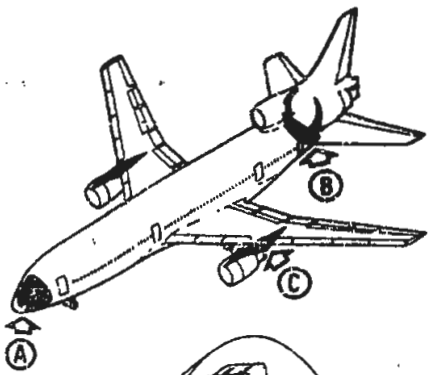
B. Operation

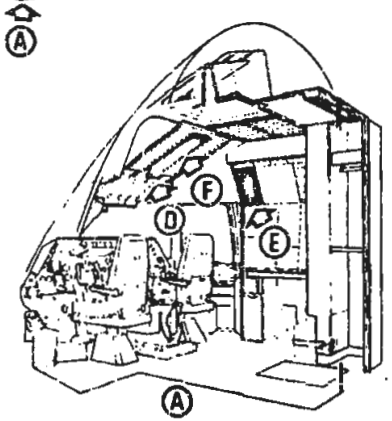
The valve will open whenever system pressure exceeds 3450 psi. The pilot valve opens at this pressure and directs pressure to the large poppet control piston, which opens it to allow full-flow of 60 gpm at 3560 psi. Reseat pressure is 3300 (+100, -0) psi. The relieved pressure flow is directed into the return line to the reservoir. The valves are used to protect the systems from excessive pressure caused by a hydraulic pump compensator valve malfunction.

14. Hydraulic System Priority Valve

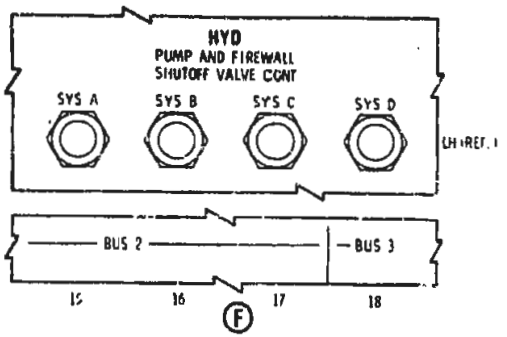
A. Description

Priority valves installed in systems A and C provide hydraulic priority for the primary flight controls: the ailerons, the spoilers, the rudder, and the stabilizer. The secondary flight controls downstream of the priority valve are the leading edge slats and trailing edge flaps, and in system C the landing gear, brakes, and nose gear steering. When hydraulic pressure in system A or C decreases below 2230 psig, the flow to the flaps and slats will be restricted and fully stopped at 1900 psi.

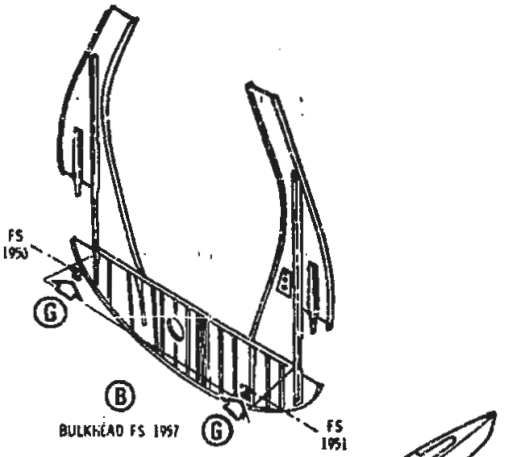


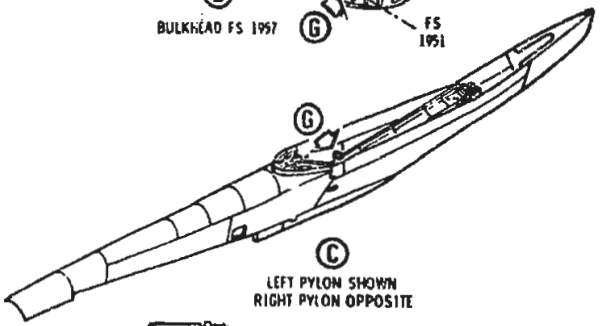


FLIGHT STATION

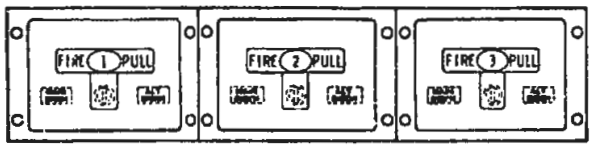


PILOTS OVERHEAD CBI PANEL

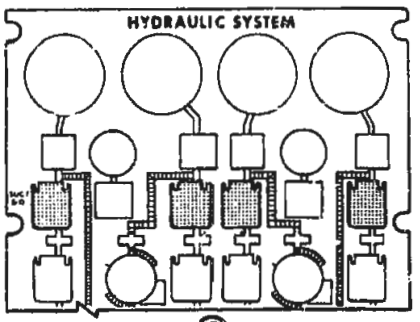




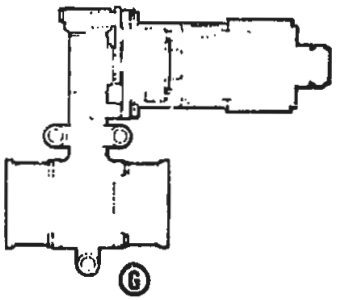
LEFT PYLON SHOWN
RIGHT PYLON OPPOSITE



FIRE PULL HANDLES



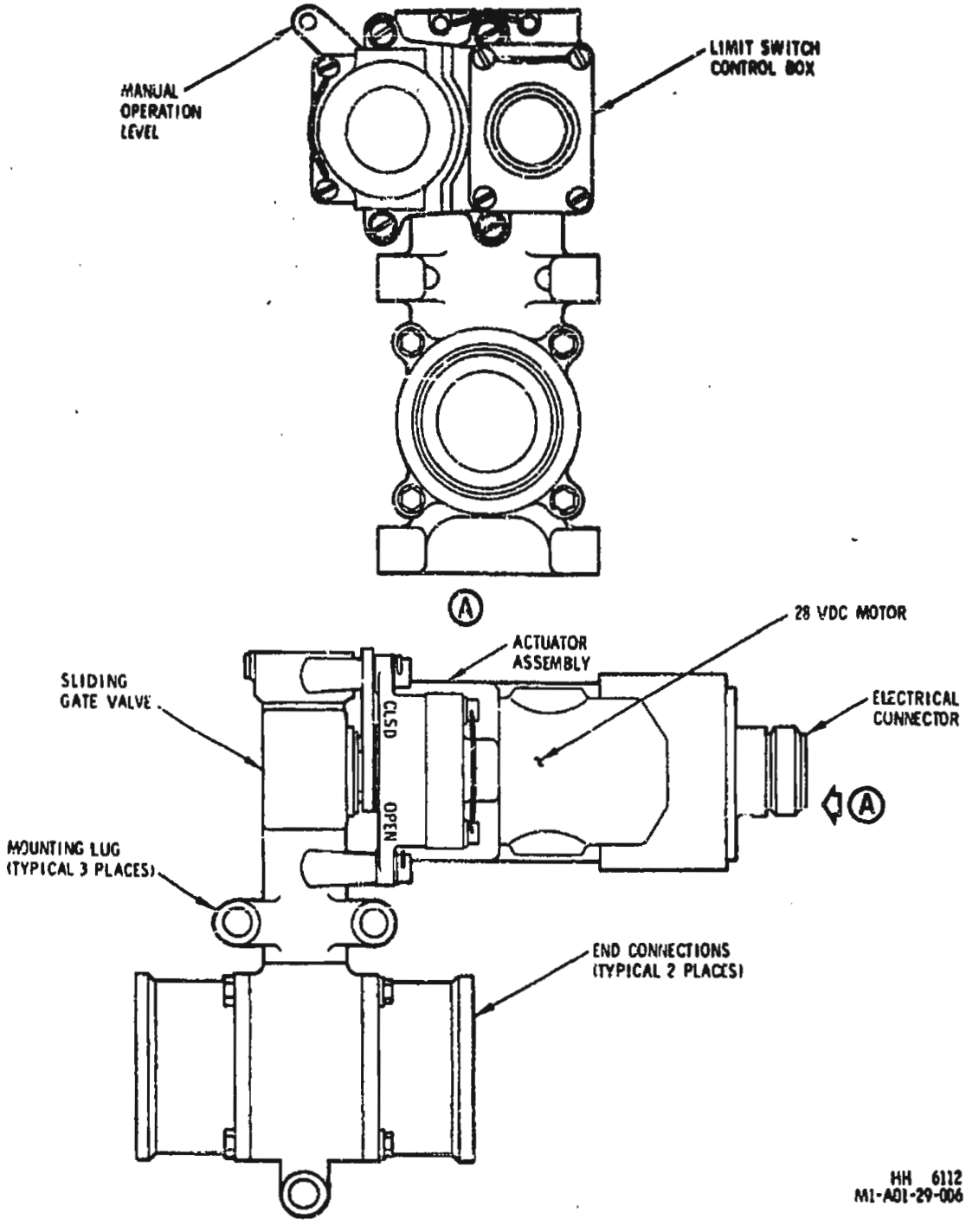
HYDRAULIC SYSTEM PANEL
SUCTION SHUTOFF SWITCHES



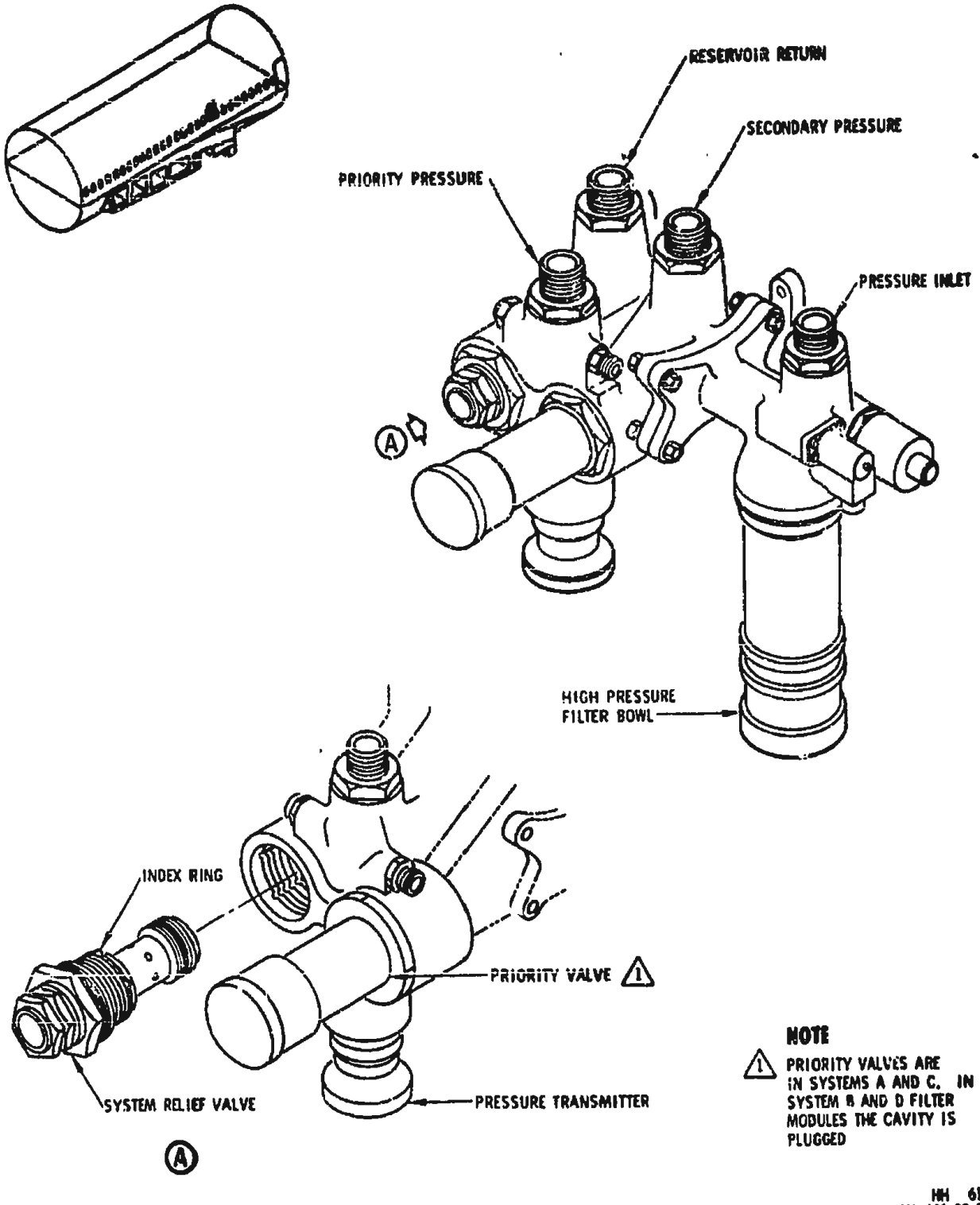
HYDRAULIC FIREWALL SHUTOFF VALVE

G370
M1-5101-29-119

Firewall Shutoff Valves Electrical Control Components Locator
Figure 21



Hydraulic Firewall Shutoff Valve
Figure 22



NOTE

1 PRIORITY VALVES ARE IN SYSTEMS A AND C. IN SYSTEM B AND D FILTER MODULES THE CAVITY IS PLUGGED

HH 6160
M1-A10-29-021

Hydraulic System Relief Valve
Figure 23

The priority valve cartridges are installed in the high-pressure filter modules located in the hydraulic service center, zone 147, (Ref. Fig. 24). The priority valve for system A is installed in the filter module located on the left forward sidewall. The priority valve for system C is installed in the filter module located on the right aft sidewall.

The valve body is machined from 2024T4 aluminum alloy. The valve components are made from corrosion-resistant steel.

B. Operation

A spring-loaded poppet prevents flow through the valve when system pressure decreases to approximately 2100 psig. As pressure increases, the valve will open at approximately 2230 psig and achieve full-rated flow of 51 gpm at approximately 2450 psig. Operation of the valves is completely automatic. The valves are used to prevent momentary loss of critical primary flight control during landing gear or secondary flight control actuation.

15. Hydraulic System Check Valves

A. Description and Operation

The check valves used in the hydraulic system are spring-loaded poppet-type valves (Ref. Fig. 25), except for two pump suction line check valves, which are spring-loaded hinged flapper valves. The fittings are sized to prevent installation in the reverse position; the upstream (end No. 1) fitting is a size smaller than the downstream (end No. 2) fitting. The plumbing lines are designed in like manner, making it impossible to install the valves incorrectly.

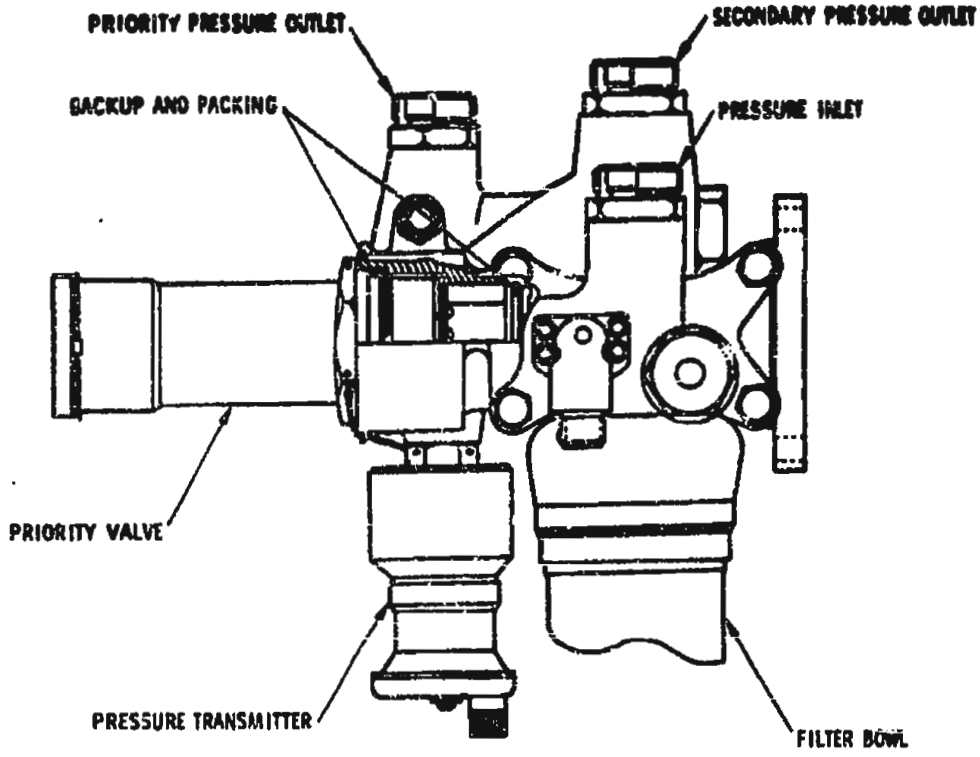
16. Hydraulic Pump Ripple Dampers

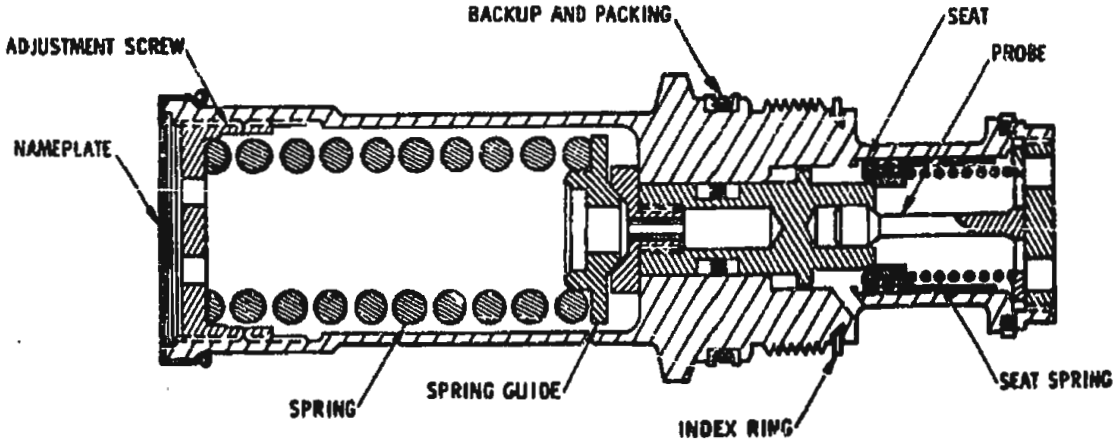
A. Description and Operation

A ripple damper, also called pulsation filter, is installed in the pressure line of certain hydraulic pumps (Ref. Fig. 26). The unit is used to reduce the pulsation noise produced by the pumps.

The ATM pump ripple dampers are installed in the pressure lines of the ATM-driven hydraulic pumps located in zones 195 and 196.

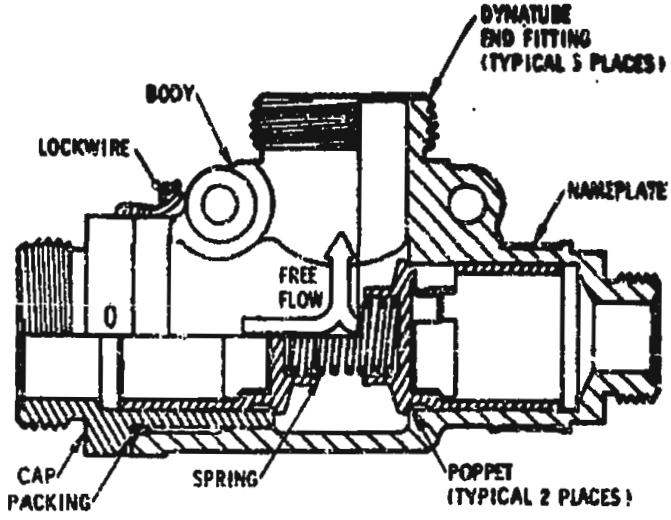
The electric motor-driven pump ripple dampers are installed in the pressure lines of the electric motor-driven pumps



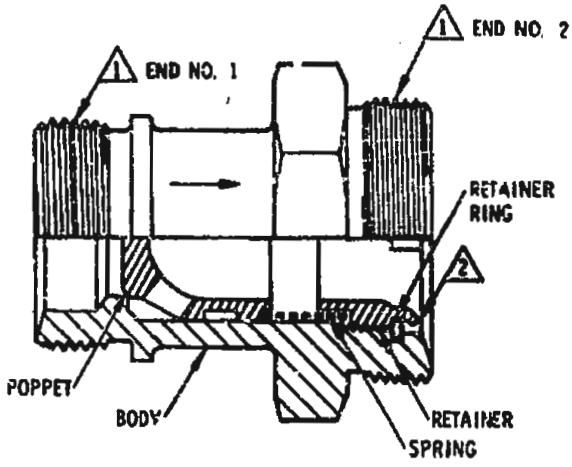


MM 9001
M1-A00-29-020

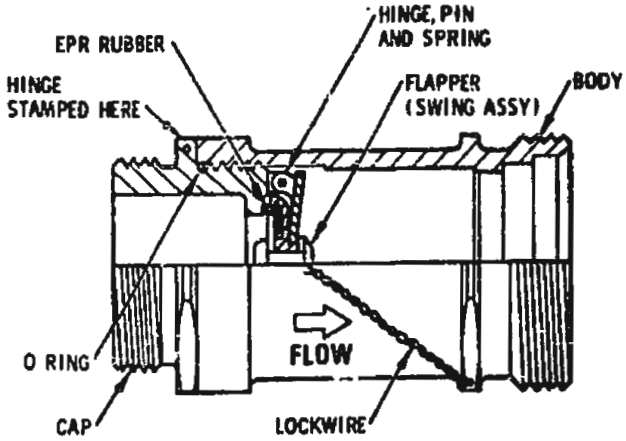
Hydraulic System Priority Valve
Figure 24



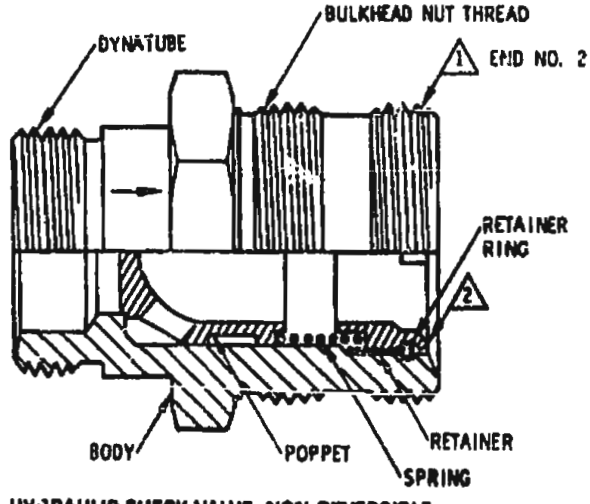
MANIFOLDED HYDRAULIC CHECK VALVE



HYDRAULIC CHECK VALVE, NON-REVERSIBLE
(IN LINE INSTALLATION)



HYDRAULIC CHECK VALVE, NON-REVERSIBLE
(HINGED FLAPPER TYPE)



HYDRAULIC CHECK VALVE, NON-REVERSIBLE

NOTE

1. NO. 2 END IS ONE SIZE LARGER THAN NO. 1 AND IS TO BE ON THE DOWN STREAM END OF VALVE
2. RETAINER TAB IS SWAGED OVER RETAINER RING TO LOCK RETAINER IN POSITION

M1-0101-29-024

Hydraulic System Check Valves
Figure 25

located on the left and right sidewalls of the hydraulic service center, zone 147.

Ripple dampers are installed in the pressure lines from No.2 engine-driven hydraulic pumps. The dampers are located in the lower aft fuselage area adjacent to the systems B and C high-pressure filter housings. The ripple dampers reduce the pump pulsation noise in the aft cabin area of the aircraft.

17. Rudder Hydraulic Fusing System

A. Description

A hydraulic fusing system is incorporated in the rudder system A pressure and return lines. The system consists of three items: a motor-operated shutoff valve in the pressure line, a differential pressure sensing check valve in the return line and a System A HYDRAULIC FUSING test panel located below the HYDRAULIC SERVICE PANEL, zone 147. The shutoff valve and check valve are on forward side of FS 1975 bulkhead, above the horizontal stabilizer pivot point, left side, zone 317.

The system provides automatic hydraulic fusing action for system A in the event of a sudden abnormal loss of pressure caused by the rupture of plumbing lines in the aft fuselage area near the fuselage mounted engine.

B. Operation

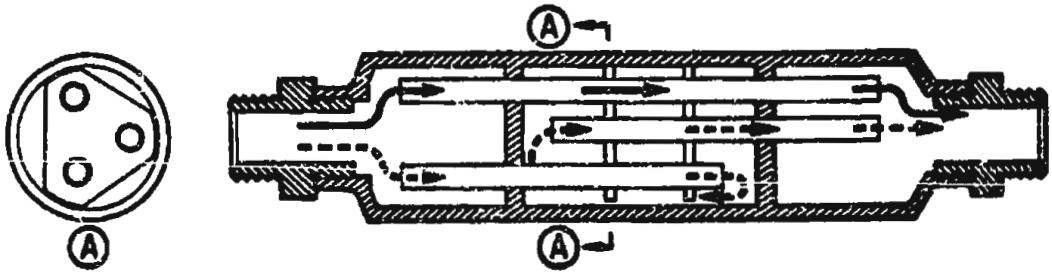
A ruptured pressure or return line in the aft fuselage area will be instantly detected by the differential pressure sensing check valve in the return line. The check valve will close due to the pressure differential caused by the loss of pressure upstream of the valve. After a predetermined time-delay, the differential-pressure sensing switch in the check valve directs 28V dc power to the motor-operated shutoff valve in the rudder system A pressure line, closing the valve. Electrical power is taken from bus No. 2 through the RUDDER FUSING SYSTEM circuit breaker on the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215 (Ref. Fig. 27).

NOTE: Cockpit indications of a closed motor operated shutoff valve are an illuminated YAW 2 SAS light and below 164 kts the Rudder Hydraulic Limiter light.

Hydraulic fusing operational check capability is provided by the SYSTEM A HYDRAULIC FUSING test panel which consists of a guarded momentary type toggle switch and a press-to-test

ATM AND NO. 2 ENGINE PUMP RIPPLE DAMPER

AC MOTOR PUMP RIPPLE DAMPER



SCHEMATIC CROSS SECTIONAL VIEW OF RIPPLE DAMPER

CODE
THROUGH PASSAGE
DIVERTED PASSAGE

HA 0948
M1-0101-29-160

Hydraulic Pump Ripple Damper
Figure 26

R
R
001B

EFFECTIVITY: ALL

indicator light. A BITE check of the system can be made, with the reservoir and return system at zero psi, by opening MLG GND SENSE (L8) circuit breaker (Ref. Fig. 27), holding the switch in the TEST position, and then pressurizing system A. The switch directs power to close the motor-operated shutoff valve. When hydraulic pressure is applied, a pressure differential is created across the check valve; the switch closes and turns on the TEST light on the panel. When the test panel switch is released to NORMAL, the TEST light will remain on. When System A pressure is turned off, and pressures in the system and in the reservoir have decayed to less than 10 psig, the check valve switch will automatically reset and the motor-operated shutoff valve in the pressure line will open and the TEST light will go out.

NOTE: When rudder system A hydraulic fusing check valve is closed, pressure to the rudder hydraulic low pressure sensor is shut off.

Below 164 kts this turns on the rudder hydraulic limiter light in the pilot's overhead panel.

18. Hydraulic Fusing Shutoff Valve

A. Description

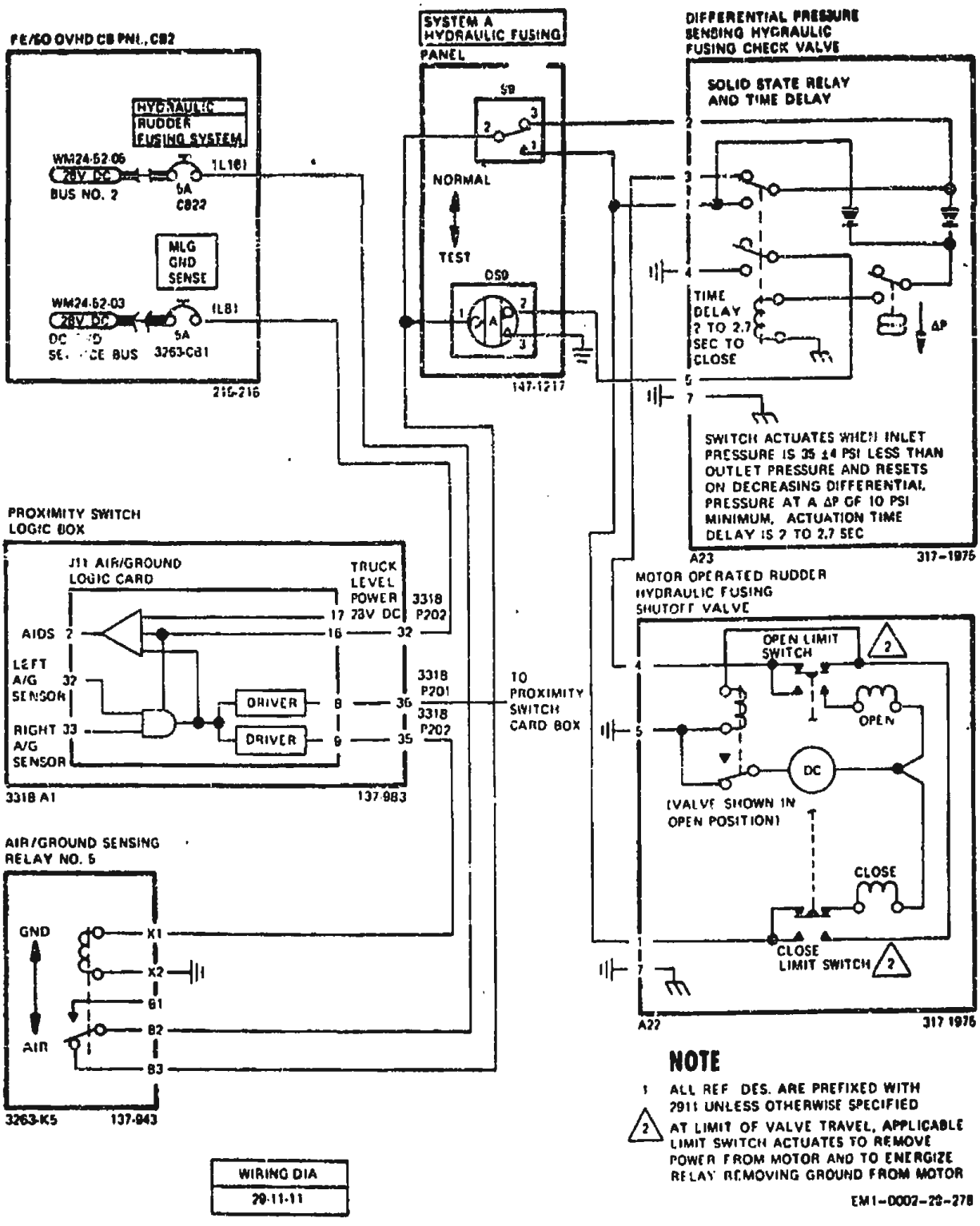
The rudder system A hydraulic fusing shutoff valve is a rotary-type valve with an external mechanical lever that provides visual indication of valve position (Ref. Fig. 28). The porting plate is actuated by a 28V dc reversing type electrical motor. The valve is mounted on FS 1975, forward side, above the horizontal stabilizer left pivot point. System A hydraulic pressure to the rudder servo is ported through the shutoff valve. The rudder fusing check valve in the return line is mounted next to the shutoff valve.

A restrictor union in the shutoff valve inlet port reduces the fluid loss during a system plumbing failure.

19. Hydraulic Fusing Check Valve

A. Description

The rudder system A hydraulic fusing check valve consists of the following (Ref. Fig. 29): a poppet type check valve, a differential pressure sensing self-resetting spool valve for driving a proximity sensor (Hall Sensor), and a dual circuit solid state switching device with a time delay.

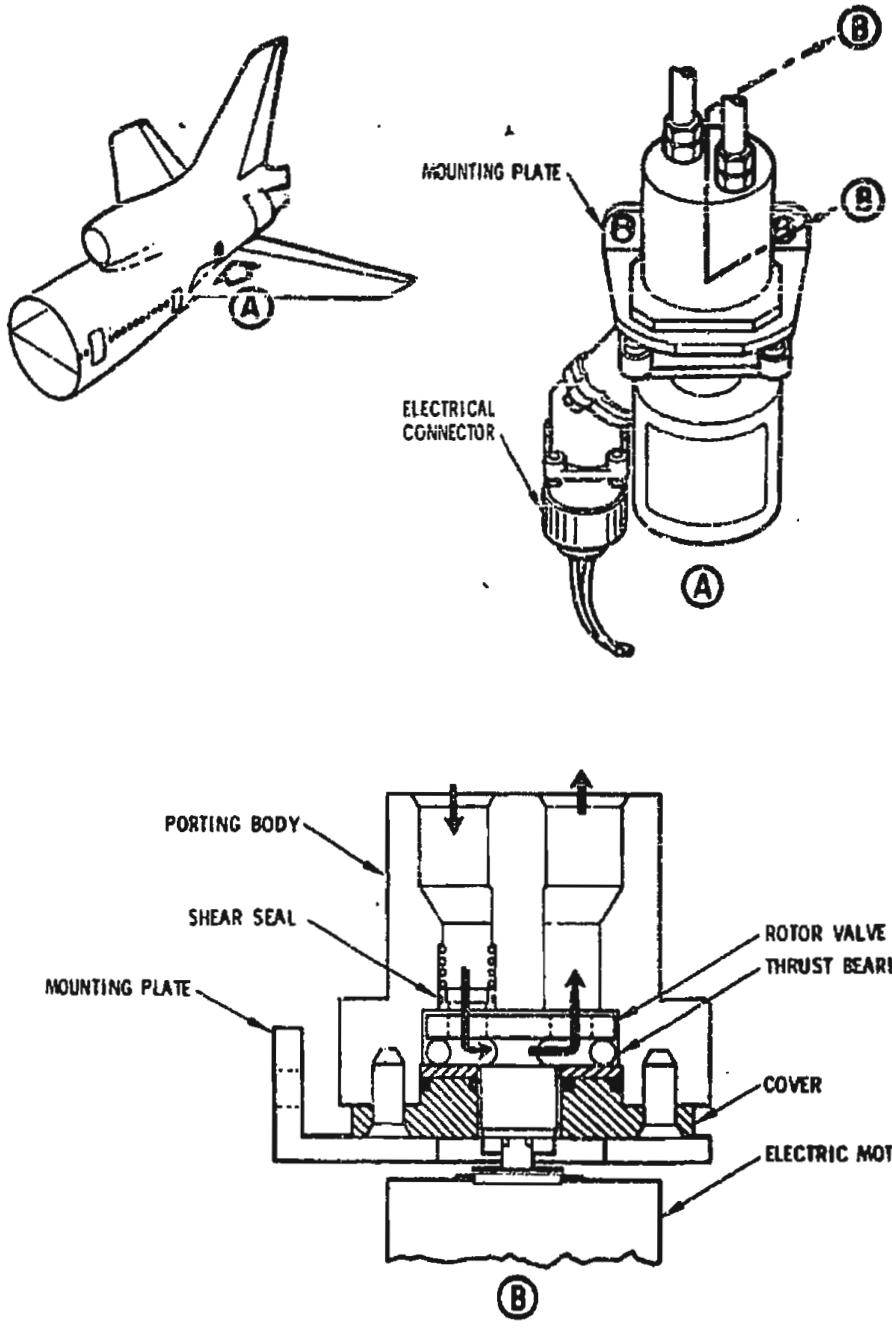


NOTE

1. ALL REF DES. ARE PREFIXED WITH 2911 UNLESS OTHERWISE SPECIFIED
2. AT LIMIT OF VALVE TRAVEL, APPLICABLE LIMIT SWITCH ACTUATES TO REMOVE POWER FROM MOTOR AND TO ENERGIZE RELAY REMOVING GROUND FROM MOTOR

EM1-0002-29-278

Rudder System A Hydraulic Fusing Electrical Schematic
Figure 27



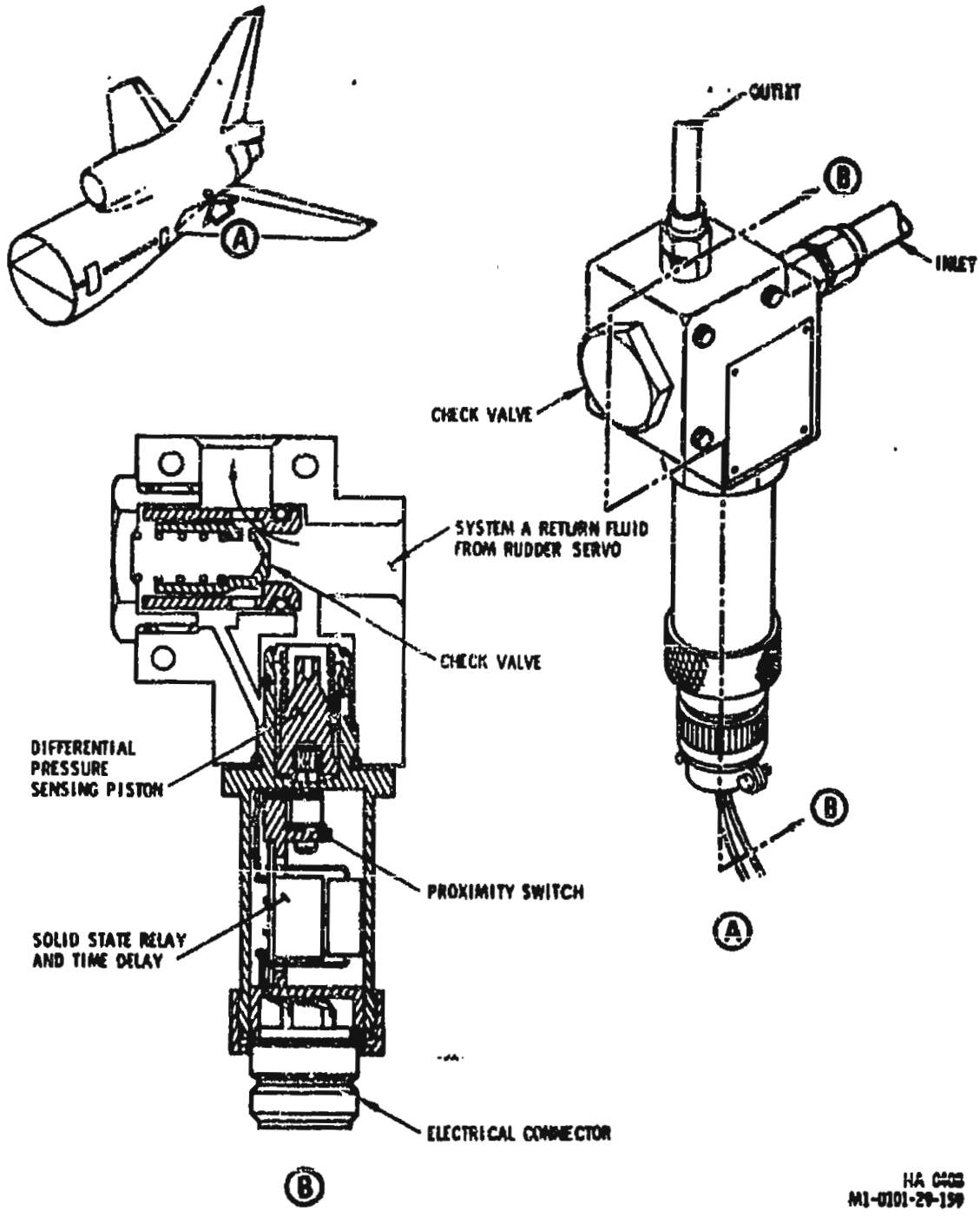
M1-0100-29-158

Hydraulic Fusing Shutoff Valve
Figure 28

Switch actuation occurs when the spool valve detects a pressure differential across the check valve which causes the spool valve to shift, moving the spool away from the proximity sensor. When this occurs, a signal is sent through the amplifier to the time delay and to both the test panel light and the close windings of the hydraulic fusing shutoff valve (Ref. Fig. 27). The differential pressure switch is actuated when the return line inlet pressure decreases to 35 psi maximum below outlet pressure. The switch resets with increasing inlet pressure below outlet pressure between 10 psi and the actuation pressure or with decreasing outlet pressure between activation pressure and 10 psi.

The fusing check valve assembly is mounted on the forward side of FS 1975 above the horizontal stabilizer left pivot point.

An electronic time delay (2 to 2.7 seconds) in the pressure-sensing switch circuit prevents inadvertant switch actuation caused by pressure fluctuations in the pressure and return lines. Normal system operation, initial system pressurization or rapid stabilizer movement, can cause the return line fluid column to accelerate and decelerate resulting in pressure surges that would cause the pressure sensing check valve to actuate.



HA C008
M1-0101-29-159

Hydraulic Fusing Check Valve
Figure 29

R # HYDRAULIC POWER SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

R If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 29 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in this section.

R Hydraulic Power System Fault Isolation
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Pump Outlet LO PR Light On
104	Case Drain HI-TEM Light On
105	RSVR LO QTY Light On
106	RSVR HI TEM Light On
107	Hydraulic Fluid Quantity Indication Abnormal

Hydraulic Power System Fault Isolation (Cont)
Table 101

FIGURE	TITLE
108	Hydraulic System Fluid Loss
109	ATM Control System Problems
110	ATM RPM Abnormal
111	ATM Fault Lights
112	PTU System Pressure Problems
113	PTU Control System Problems
114	AC Pumps Pressure/Temperature Problems
115	AC Pumps Control Problems
116	Rudder System A Hydraulic Fusing Fault Isolation
117	Hydraulic Pressure Indication Abnormal
118	Engine-driven Pump Control Problems
SCHEM 1	System A Engine-driven Pump Electrical Schematic
SCHEM 2	System B Engine-driven Pump Electrical Schematic
SCHEM 3	System C Engine-driven Pump Electrical Schematic
SCHEM 4	System D Engine-driven Pump Electrical Schematic
SCHEM 5	ATM Pumps Electrical Schematic
SCHEM 6	PTU B-A Electrical Schematic
SCHEM 7	PTU C-D Electrical Schematic
SCHEM 8	AC Pumps Electrical Schematic
SCHEM 9	Rudder System A Hydraulic Fusing Electrical Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCUMULATOR – BRAKE	2	HSC, ENDWALL	32-43-00, 01
ACCUMULATOR – RAT	1	HSC, SIDEWALL	29-21-16
ACCUMULATOR – RESERVOIR	4	HSC, SIDEWALLS	29-13-00
CARD – ILCB 1A24/1A26	2	FESC, ILCB	33-17-00
CIRCUIT BREAKER – AC HYD PUMP MAGNETIC	2	MESC, MAGNETIC CIRCUIT BREAKER PANEL	*
CIRCUIT BREAKER – RCCB AC HYD PUMP	2	MESC, 3PH-50 AMP	29-24-03
CIRCUIT BREAKERS:			
AC HYD MOTOR IND CB16	1	FLT STA/CB2 L10	*
AC PUMP B3 CB17	1	FLT STA/CB2 L12	*
AC PUMP C3 CB18	1	FLT STA/CB2 L22	*
ATM PUMP CONT/IND SYS B 2933-CB1	1	FLT STA/CB2 L13	*
ATM PUMP CONT/IND SYS C 2953-CB2	1	FLT STA/CB2 L19	*
EMER/LX FEED ENG 1 CB23	1	FLT STA/CB3 T7	*
EMER/RX FEED ENG 3 CB28	1	FLT STA/CB3 T13	*
GEN OVERLOAD PROTECT 2451-CB6	1	FLT STA/CB3 G14	*
IND LT SYS A PUMP 2932-CB13	1	FLT STA/CB2 M15	*
IND LT SYS B PUMP 2932-CB14	1	FLT STA/CB2 M17	*
IND LT SYS C PUMP 2932-CB15	1	FLT STA/CB2 M19	*
IND LT SYS D PUMP 2932-CB16	1	FLT STA/CB2 M21	*
MLG GROUND SENSE 3263-CB1	1	FLT STA/CB2 L8	*
PTU CONT/IND SYS B–A CB14	1	FLT STA/CB2 L14	*
PTU CONT/IND SYS C–D CB15	1	FLT STA/CB2 L15	*
PUMP/FIREWALL SHUTOFF SYS A CB1	1	FLT STA/CB1 L15	*
PUMP/FIREWALL SHUTOFF SYS B CB2	1	FLT STA/CB1 L16	*
PUMP/FIREWALL SHUTOFF SYS C CB3	1	FLT STA/CB1 L17	*
PUMP/FIREWALL SHUTOFF SYS D CB4	1	FLT STA/CB1 L18	*
RUDDER FUSING SYSTEM CB22	1	FLT STA/CB2 L16	*
COMPENSATOR – TEMPERATURE	4	HSC, ABOVE RESERVOIR	29-31-13
CONTROLLER – ATM	1	MESC, AFT BULKHEAD	29-11-40
FILTER – ATM CASE DRAIN	2	HSC, SIDEWALL	29-11-26
INDICATOR – FLUID LEVEL	4	FLT STA/FE/SO PANEL	29-31-10
INDICATOR – FLUID PRESSURE	4	FLT STA/FE/SO PANEL	29-31-09
MODULE – PTU CONTROL 2911-P17/P18	2	HSC, AFT OF PTU	29-11-34
PTU	2	HSC, SIDEWALL	29-11-33
PUMPS – AC MOTOR	2	HSC, SIDEWALL	29-11-08
PUMPS – ATM	2	MLG WW FUS FAIRING	29-11-71
PUMPS – ENGINE DRIVEN	4	ENG ACCESSORY GEARBOX	29-11-07
RELAY – PTU CONTROL K4/K5	2	FESC, RIGHT SIDEWALL	29-11-00

*SEE WM EQUIPMENT LIST

M1-0000-29-999

R
R

Component Location Index
Figure 101 (Sheet 1)

EFFECTIVITY: ALL

001B

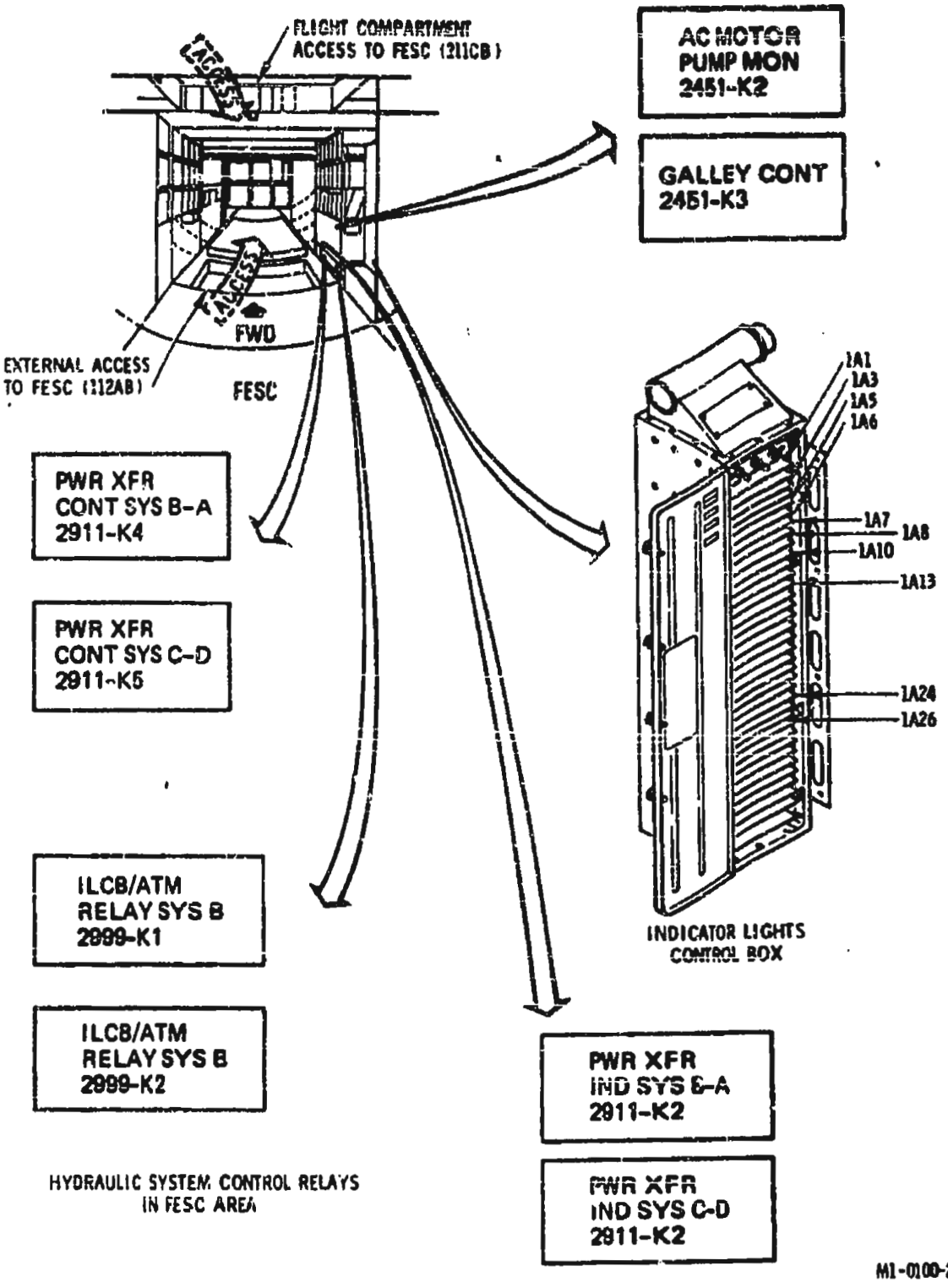
COMPONENT	QTY	AREA/ACCESS	REFERENCE
RELAY – PTU LATCHING K1/K2	2	FESC, RIGHT SIDEWALL	29-11-00
RESERVOIR	4	HSC, SIDEWALL	29-11-01
SWITCH – ATM BUS PRESSURE	2	MLG WW FUS FAIRING	29-11-78
SWITCH – ATM CASE DRAIN HI-TEMP	2	HSC, CASE DRAIN FILTER	29-32-02
SWITCH – ATM LOW PRESSURE WARNING	2	HSC, FILTER MODULES	29-32-01
SWITCH – ATM LUBE LOW PRESSURE	2	MLG WW FUS FAIRING	29-33-00
SWITCH – CASE DRAIN THERMAL	4	CASE DRAIN FILTER	29-32-02
SWITCH – LOW PRESSURE WARNING	4	HIGH PRESSURE FILTER	29-32-01
SWITCH – RESERVOIR THERMAL	4	HSC, RESERVOIR	29-32-03
TACHOMETER – ATM	2	FLT STA/FE/SO PANEL	29-11-00
TRANSMITTER – RESERVOIR QUANTITY	4	HSC, RESERVOIR	29-11-12
TRANSMITTER – RESERVOIR TEMP	4	HSC, RESERVOIR	29-31-12
VALVE – ATM AIR CONTROL	2	MLG WW FUS FAIRING	29-11-62
VALVE – FIREWALL SHUTOFF ENG 1 & 3	2	ENGINE PYLON	29-11-32
VALVE – FIREWALL SHUTOFF ENG 2	2	AFT FUS BHD FS 1956	29-11-32
VALVE – PTU FLOW REGULATOR	2	HSC, SIDEWALL	29-11-37
VALVE – PTU SHUTOFF	2	HSC, SIDEWALL	29-11-36
VALVE – PUMP DEPRESSURIZING	6	ATM & ENG DRIVEN PUMPS	29-11-83
VALVE – RESERVOIR DEPRESSURIZING	4	HSC, RESERVOIR	29-11-82
VALVE – RUDDER HYD FUSING CHECK	1	AFT FUS FS 1975	29-11-75
VALVE – RUDDER HYD FUSING SHUTOFF	1	AFT FUS FS 1975	29-11-74
VALVE – SYSTEM RELIEF	4	HSC FILTER MODULE	29-11-29

*SEE WM EQUIPMENT LIST

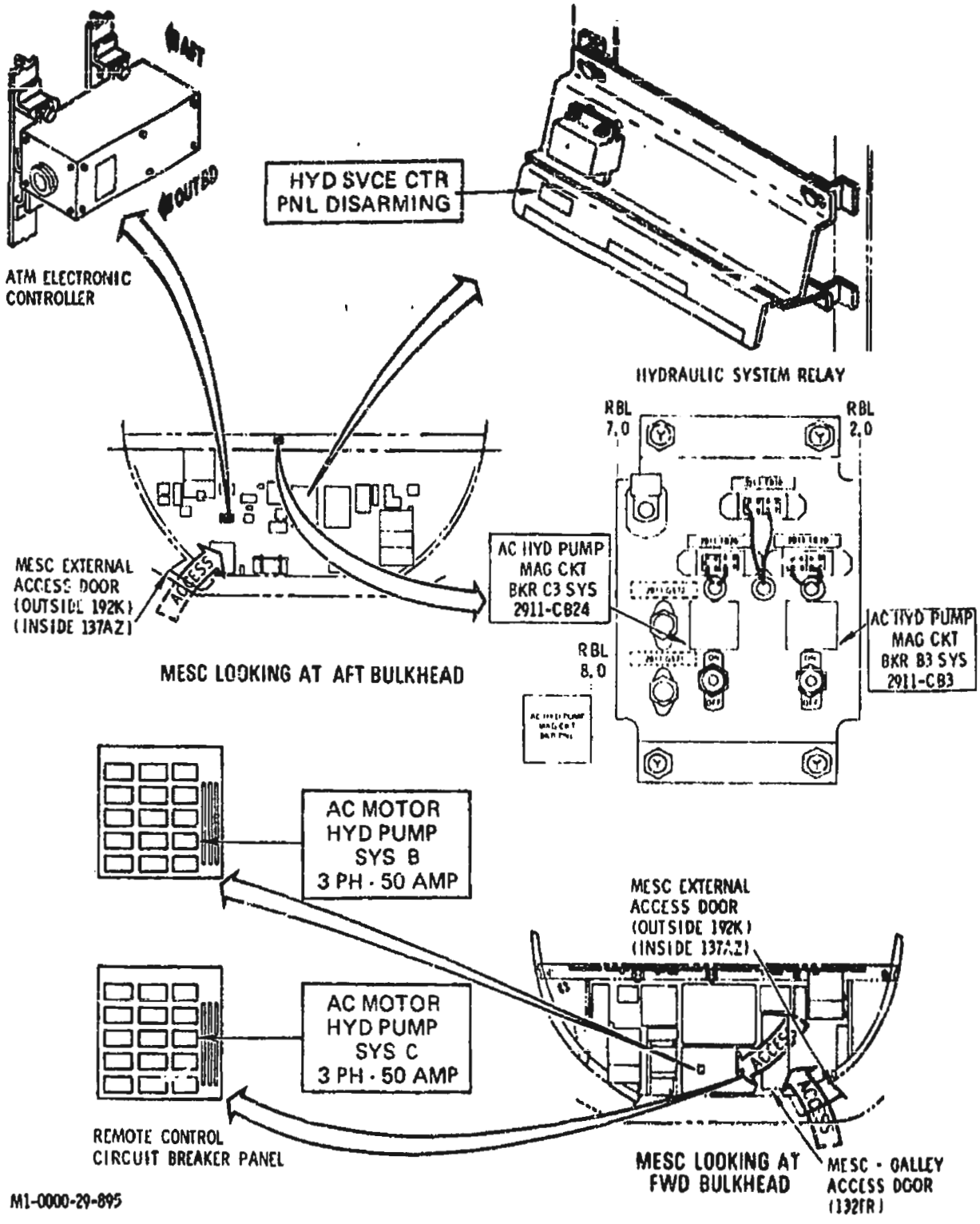
M1-0000-29-[illegible]

Component Location Index
Figure 101 (Sheet 2)

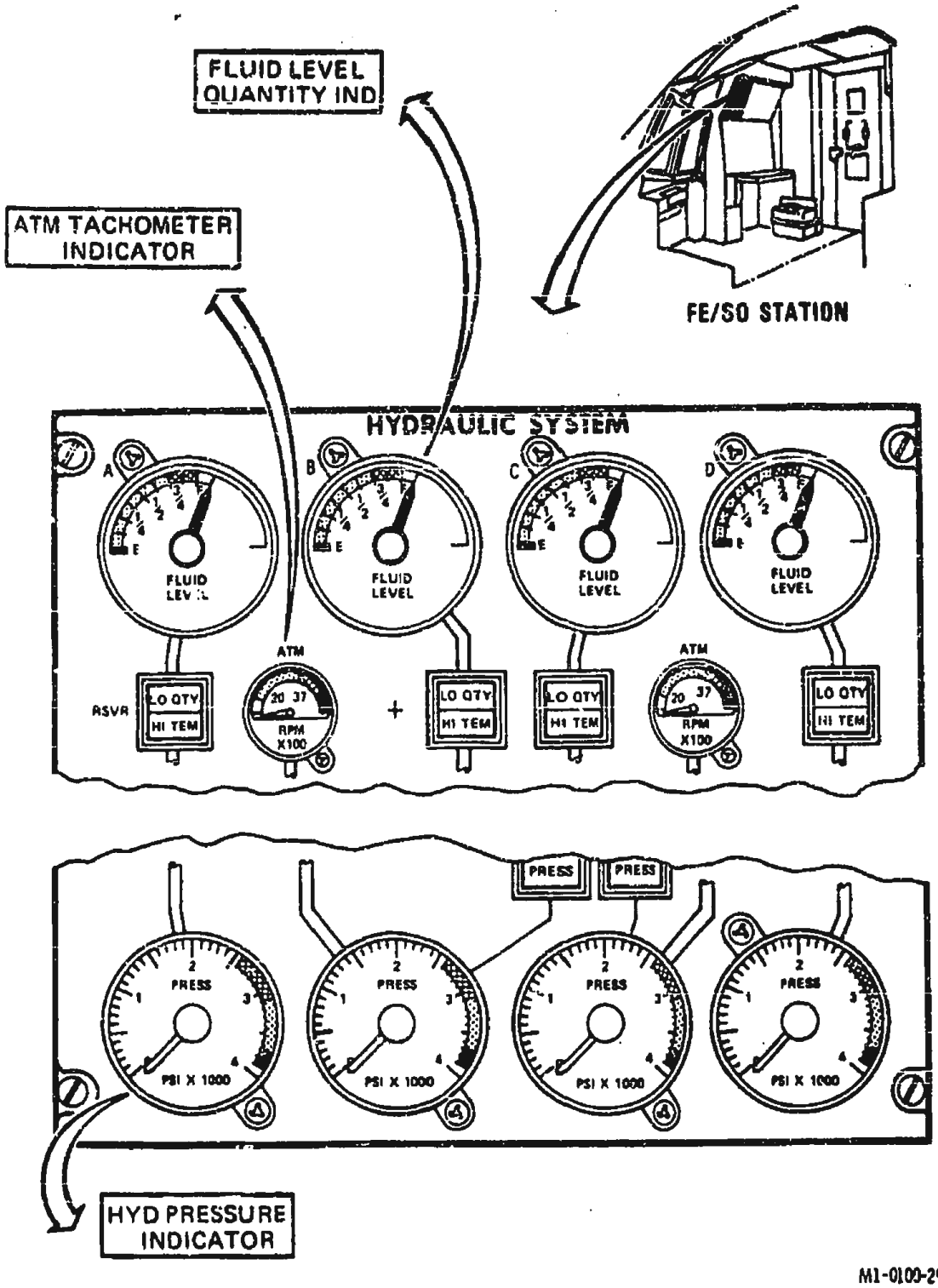
R EFFECTIVITY: ALL
R
001B



Hydraulic System Component Locator Diagram
Figure 102 (Sheet 1)

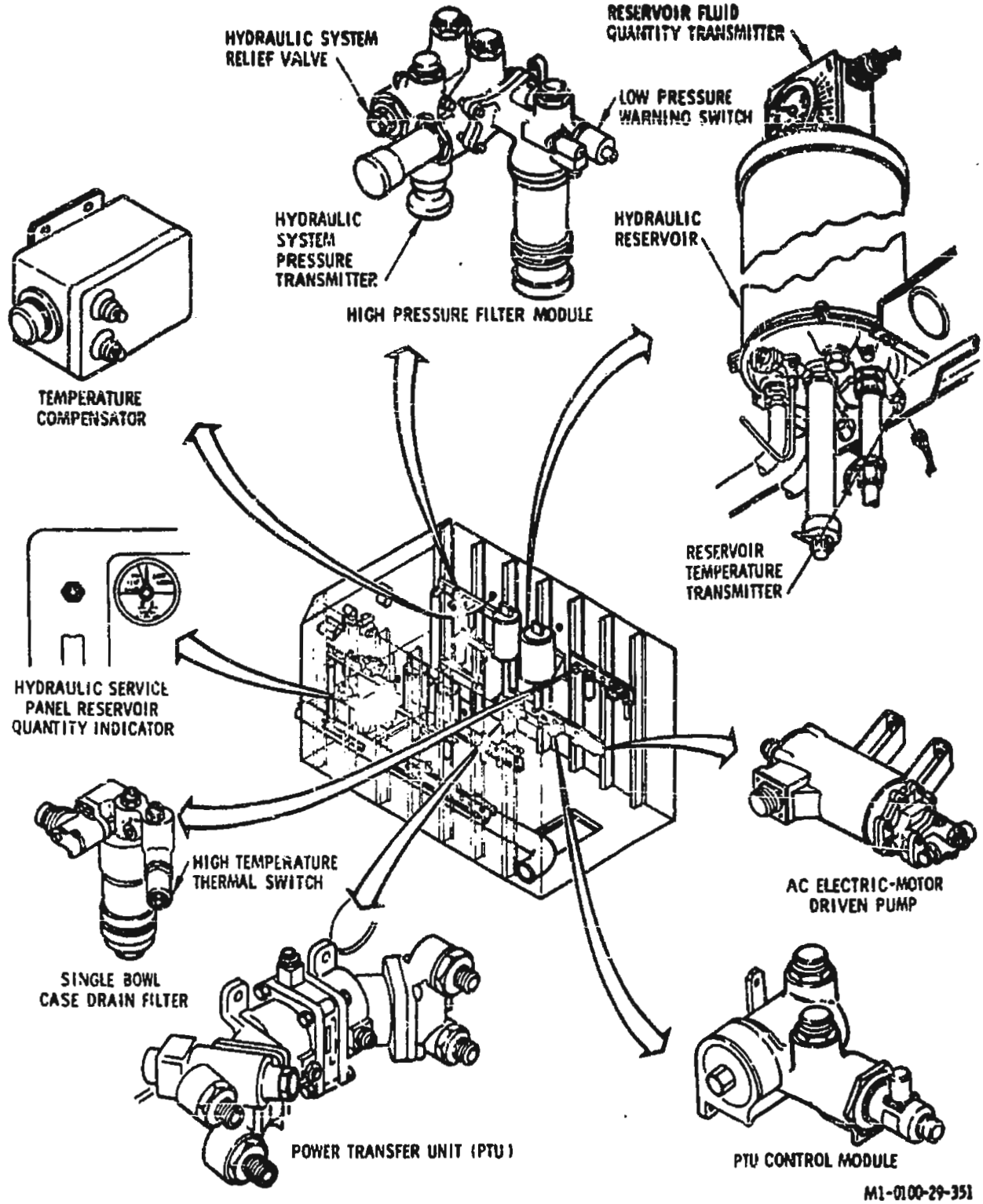

FWD
OUTBD
ATM ELECTRONIC CONTROLLER
HYD SVCE CTR PNL DISARMING
HYDRAULIC SYSTEM RELAY
RBL 7,0
RBL 2,0
RBL 8,0
AC HYD PUMP MAG CKT BKR C3 SYS 2911-CB24
AC HYD PUMP MAG CKT BKR B3 SYS 2911-CB3
MESC EXTERNAL ACCESS DOOR (OUTSIDE 192K) (INSIDE 137AZ)
ACCESS
MESC LOOKING AT AFT BULKHEAD
AC MOTOR HYD PUMP SYS B 3 PH - 50 AMP
AC MOTOR HYD PUMP SYS C 3 PH - 50 AMP
REMOTE CONTROL CIRCUIT BREAKER PANEL
MESC EXTERNAL ACCESS DOOR (OUTSIDE 192K) (INSIDE 137AZ)
MESC LOOKING AT FWD BULKHEAD
MESC - GALLEY ACCESS DOOR (132FR)
M1-0000-29-895

Hydraulic System Component Locator Diagram
Figure 102 (Sheet 2)

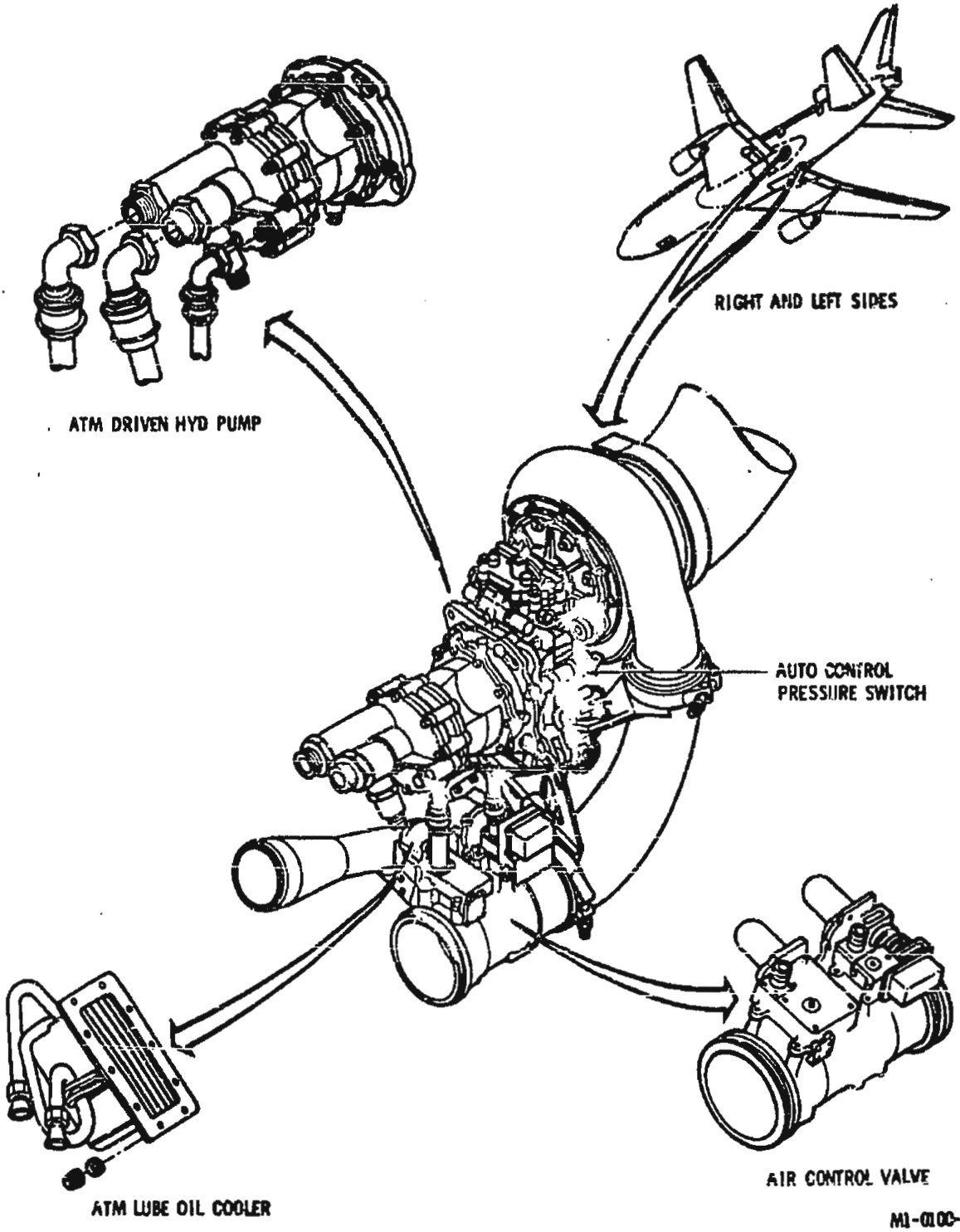


M1-0100-29-350

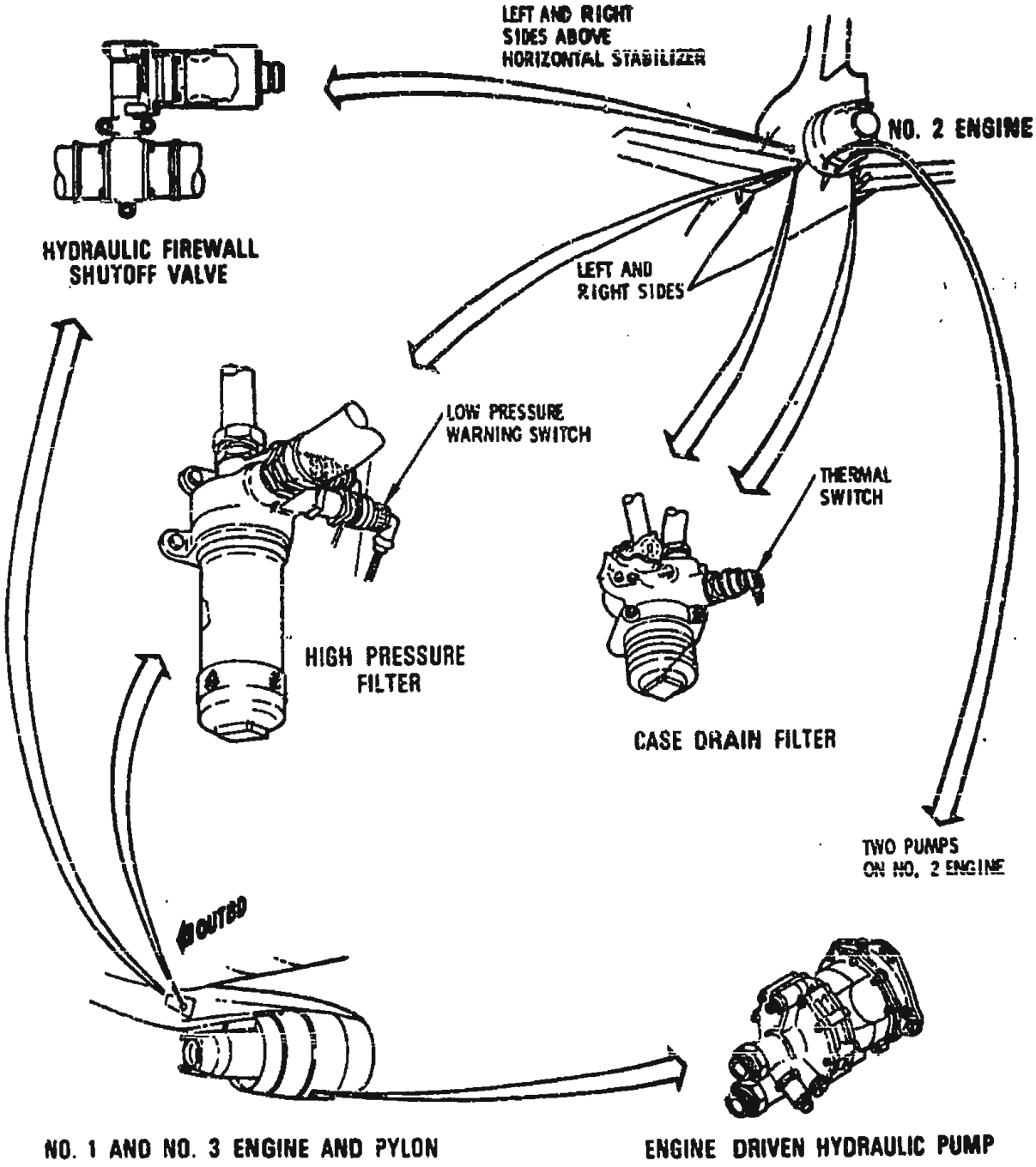
Hydraulic System Component Locator Diagram
Figure 102 (Sheet 3)



Hydraulic System Component Locator Diagram
Figure 102 (Sheet 4)



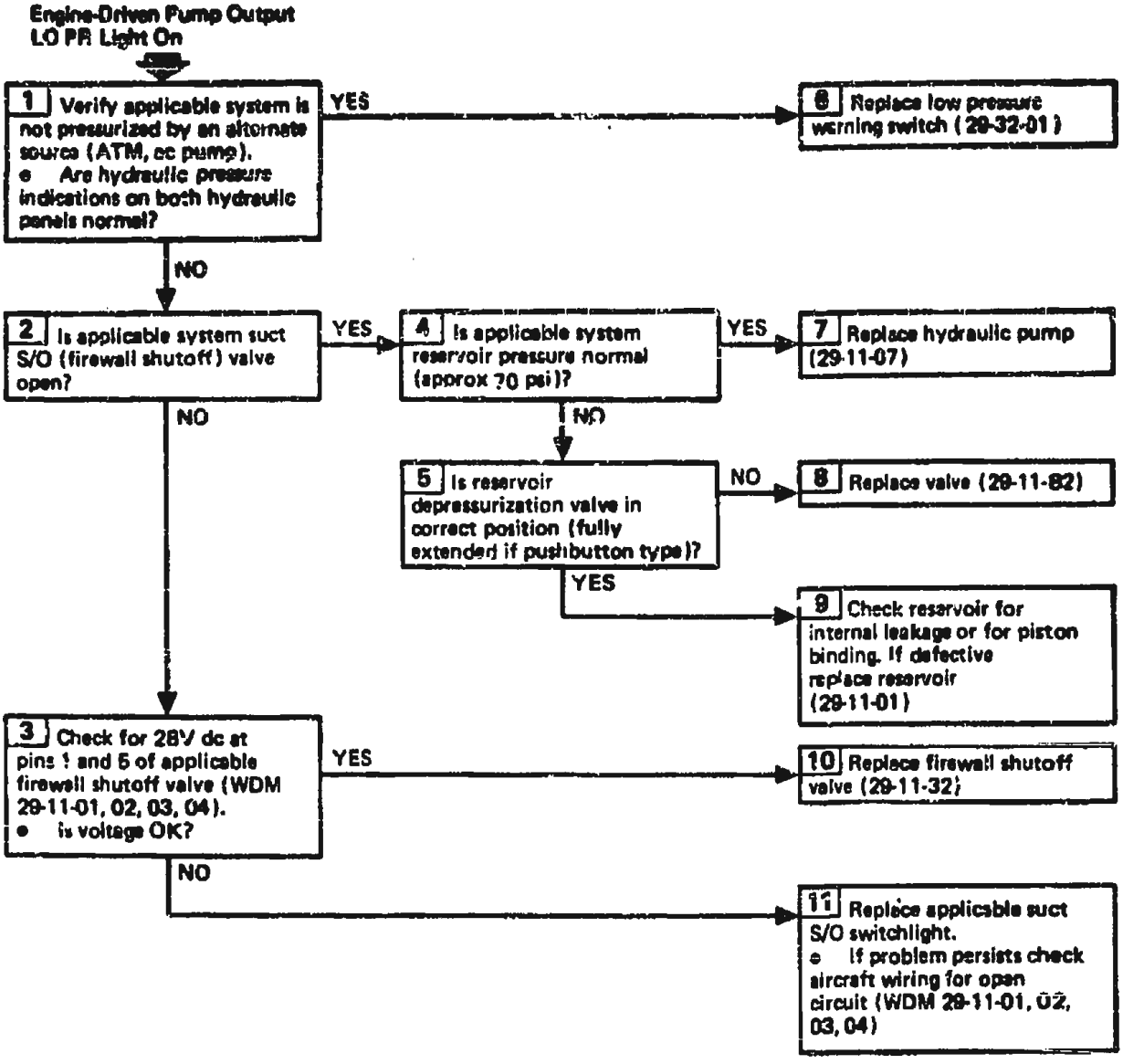
Component Locator Diagram
Figure 102 (Sheet 5)


LEFT AND RIGHT SIDES ABOVE HORIZONTAL STABILIZER
NO. 2 ENGINE
HYDRAULIC FIREWALL SHUTOFF VALVE
LEFT AND RIGHT SIDES
LOW PRESSURE WARNING SWITCH
THERMAL SWITCH
HIGH PRESSURE FILTER
CASE DRAIN FILTER
TWO PUMPS ON NO. 2 ENGINE
OUTBD
NO. 1 AND NO. 3 ENGINE AND PYLON
ENGINE DRIVEN HYDRAULIC PUMP

M1-0130-29-353

Component Locator Diagram
Figure 102 (Sheet 6)

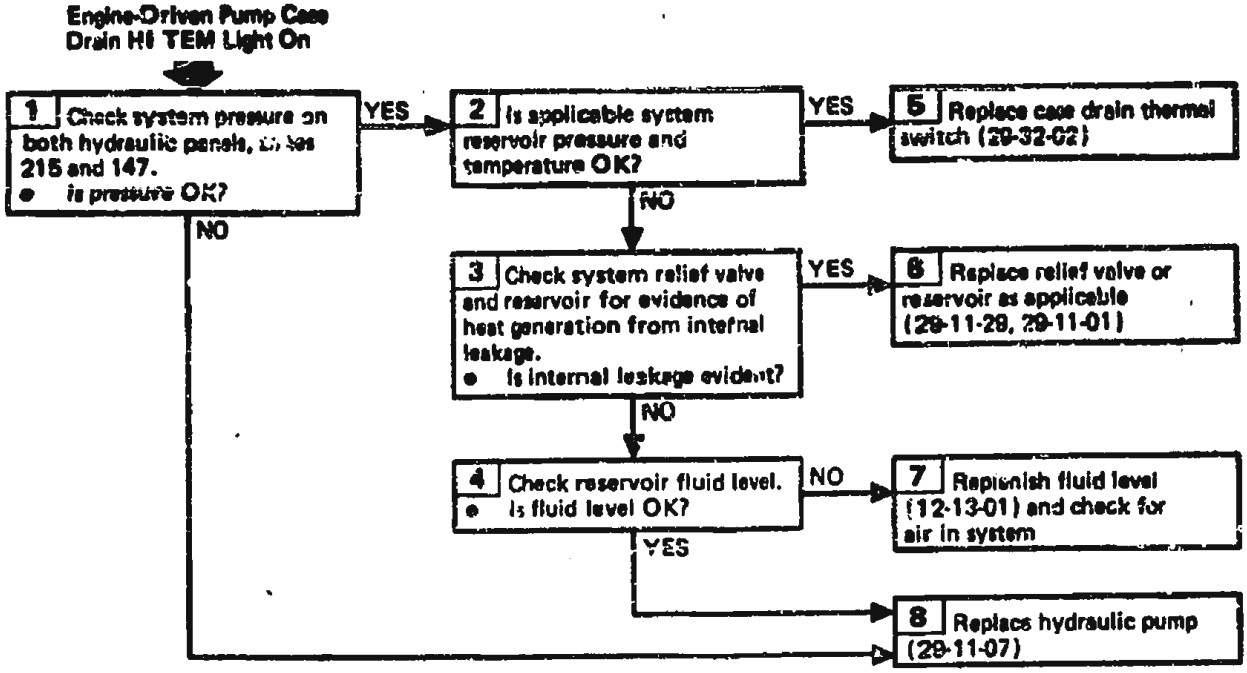
R EFFECTIVITY: ALL
R
001B


Engine-Driven Pump Output
LO PR Light On
1 Verify applicable system is not pressurized by an alternate source (ATM, ac pump).
• Are hydraulic pressure indications on both hydraulic panels normal?
YES
6 Replace low pressure warning switch (29-32-01)
NO
2 Is applicable system suct S/O (firewall shutoff) valve open?
YES
4 Is applicable system reservoir pressure normal (approx 70 psi)?
YES
7 Replace hydraulic pump (29-11-07)
NO
NO
5 Is reservoir depressurization valve in correct position (fully extended if pushbutton type)?
NO
8 Replace valve (29-11-82)
YES
9 Check reservoir for internal leakage or for piston binding. If defective replace reservoir (29-11-01)
3 Check for 28V dc at pins 1 and 5 of applicable firewall shutoff valve (WDM 29-11-01, 02, 03, 04).
• Is voltage OK?
YES
10 Replace firewall shutoff valve (29-11-32)
NO
11 Replace applicable suct S/O switchlight.
• If problem persists check aircraft wiring for open circuit (WDM 29-11-01, 02, 03, 04)

PREREQUISITES
Electrical Power (24-41-00)
Hydraulic Power (29-11-00)
CB's: CB1-L15, 16, 17, 18
CB2-M15, 17, 19, 21

M1-24904-29-849

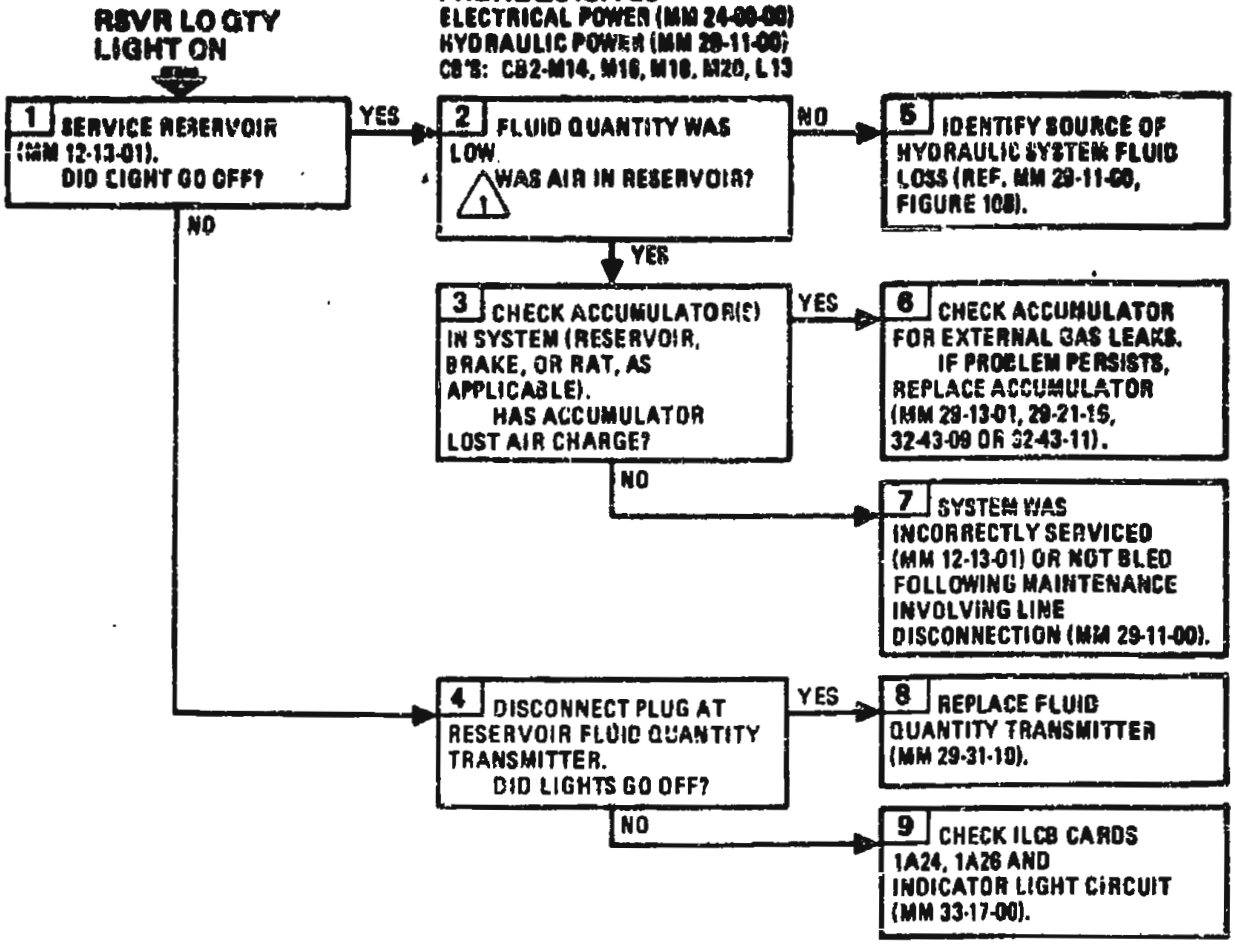
Engine-Driven Pump Outlet LO PR Light On
Figure 103


Engine-Driven Pump Case Drain HI TEM Light On
1 Check system pressure on both hydraulic panels, buses 215 and 147.
• Is pressure OK?
YES
2 Is applicable system reservoir pressure and temperature OK?
YES
5 Replace case drain thermal switch (29-32-02)
NO
3 Check system relief valve and reservoir for evidence of heat generation from internal leakage.
• Is internal leakage evident?
YES
6 Replace relief valve or reservoir as applicable (29-11-29, 29-11-01)
NO
4 Check reservoir fluid level.
• Is fluid level OK?
NO
7 Replenish fluid level (12-13-01) and check for air in system
YES
8 Replace hydraulic pump (29-11-07)

PREREQUISITES
Electrical Power (24-41-00)
Hydraulic Power (29-11-00)
CB's: CB2-M14, M16, M18, M20, L13

M1-0102-29-660

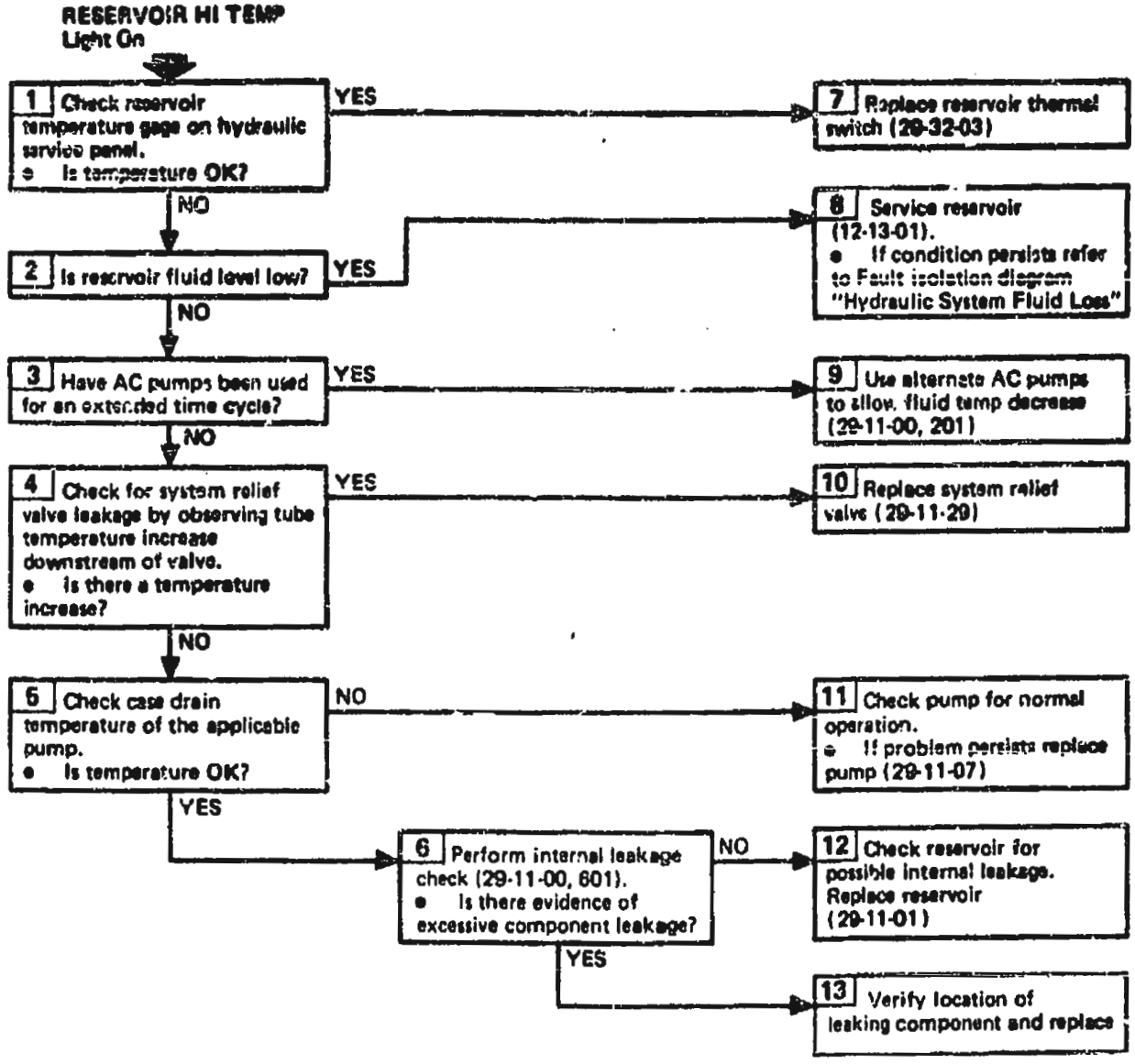
Engine-Driven Pump Case Drain HI-TEM Light On
Figure 104


PREREQUISITES
ELECTRICAL POWER (MM 24-00-00)
HYDRAULIC POWER (MM 29-11-00)
CB'S: CB2-M14, M16, M18, M20, L13
RSVR LO QTY LIGHT ON
1 SERVICE RESERVOIR (MM 12-13-01). DID LIGHT GO OFF?
YES
NO
2 FLUID QUANTITY WAS LOW. WAS AIR IN RESERVOIR?
1
NO
5 IDENTIFY SOURCE OF HYDRAULIC SYSTEM FLUID LOSS (REF. MM 29-11-00, FIGURE 108).
YES
3 CHECK ACCUMULATOR(S) IN SYSTEM (RESERVOIR, BRAKE, OR RAT, AS APPLICABLE). HAS ACCUMULATOR LOST AIR CHARGE?
YES
6 CHECK ACCUMULATOR FOR EXTERNAL GAS LEAKS. IF PROBLEM PERSISTS, REPLACE ACCUMULATOR (MM 29-13-01, 29-21-15, 32-43-09 OR 32-43-11).
NO
7 SYSTEM WAS INCORRECTLY SERVICED (MM 12-13-01) OR NOT BLED FOLLOWING MAINTENANCE INVOLVING LINE DISCONNECTION (MM 29-11-00).
NO
4 DISCONNECT PLUG AT RESERVOIR FLUID QUANTITY TRANSMITTER. DID LIGHTS GO OFF?
YES
8 REPLACE FLUID QUANTITY TRANSMITTER (MM 29-31-10).
NO
9 CHECK ILCB CARDS 1A24, 1A26 AND INDICATOR LIGHT CIRCUIT (MM 33-17-00).

1 **NOTE**
DAMAGE TO THE ENGINE DRIVEN PUMP IS PROBABLE, AS A PRECAUTION REPLACE THE PUMP (MM 29-11-07). INSPECT THE ENGINE PUMP PRESSURE AND CASE DRAIN FILTERS FOR CONTAMINATION. FLUSH PLUMBING AS REQUIRED.

M1-0006-29-851

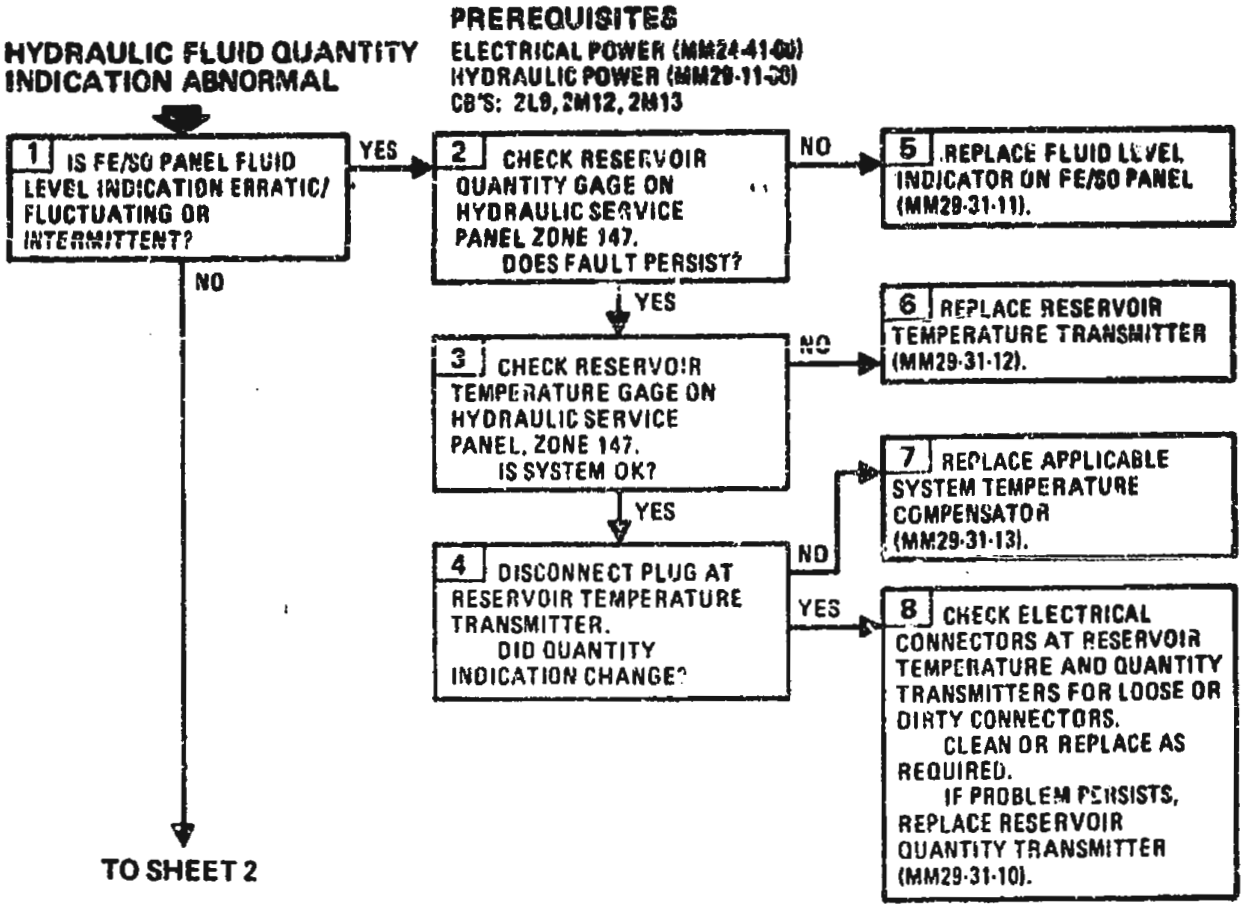
RSVR LO QTY Light ON
Figure 105


RESERVOIR HI TEMP
Light On
1 Check reservoir temperature gage on hydraulic service panel.
• Is temperature OK?
YES
7 Replace reservoir thermal switch (29-32-03)
NO
2 Is reservoir fluid level low?
YES
8 Service reservoir (12-13-01).
• If condition persists refer to Fault isolation diagram "Hydraulic System Fluid Loss"
NO
3 Have AC pumps been used for an extended time cycle?
YES
9 Use alternate AC pumps to allow fluid temp decrease (29-11-00, 201)
NO
4 Check for system relief valve leakage by observing tube temperature increase downstream of valve.
• Is there a temperature increase?
YES
10 Replace system relief valve (29-11-29)
NO
5 Check case drain temperature of the applicable pump.
• Is temperature OK?
NO
11 Check pump for normal operation.
• If problem persists replace pump (29-11-07)
YES
6 Perform internal leakage check (29-11-00, 601).
• Is there evidence of excessive component leakage?
NO
12 Check reservoir for possible internal leakage. Replace reservoir (29-11-01)
YES
13 Verify location of leaking component and replace

PREREQUISITES
Electrical Power (24-41-00)
Hydraulic Power (29-11-00)
CB's: CB2-M14, M16, M18, M20, L13

M1-0102-29-862

RSVR HI-TEM Light On
Figure 106

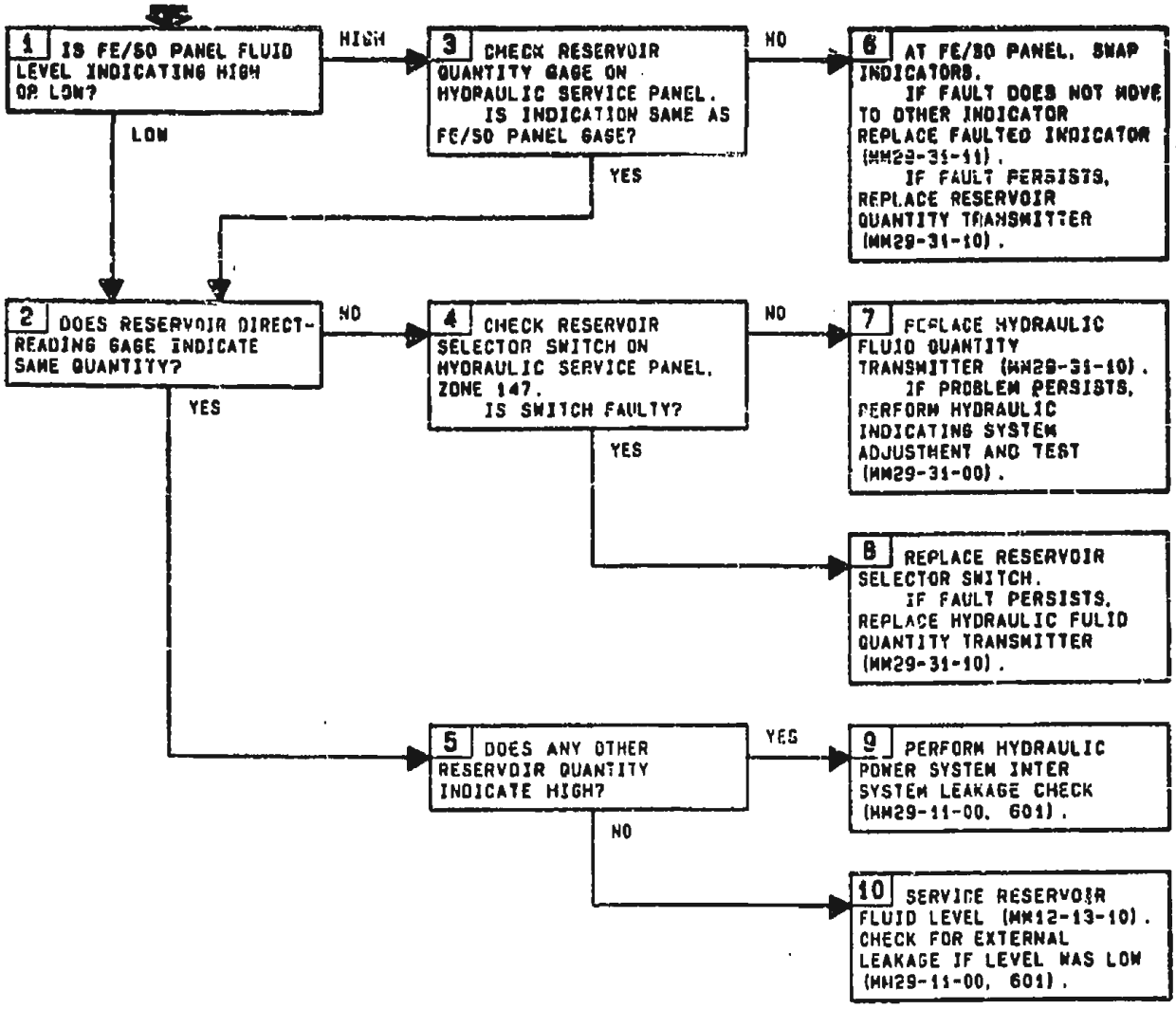

HYDRAULIC FLUID QUANTITY INDICATION ABNORMAL
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER (MM29-11-00)
CB'S: 2L9, 2M12, 2M13
1 IS FE/SO PANEL FLUID LEVEL INDICATION ERRATIC/ FLUCTUATING OR INTERMITTENT?
YES
NO
2 CHECK RESERVOIR QUANTITY GAGE ON HYDRAULIC SERVICE PANEL ZONE 147. DOES FAULT PERSIST?
NO
5 REPLACE FLUID LEVEL INDICATOR ON FE/SO PANEL (MM29-31-11).
YES
3 CHECK RESERVOIR TEMPERATURE GAGE ON HYDRAULIC SERVICE PANEL, ZONE 147. IS SYSTEM OK?
NO
6 REPLACE RESERVOIR TEMPERATURE TRANSMITTER (MM29-31-12).
YES
4 DISCONNECT PLUG AT RESERVOIR TEMPERATURE TRANSMITTER. DID QUANTITY INDICATION CHANGE?
NO
7 REPLACE APPLICABLE SYSTEM TEMPERATURE COMPENSATOR (MM29-31-13).
YES
8 CHECK ELECTRICAL CONNECTORS AT RESERVOIR TEMPERATURE AND QUANTITY TRANSMITTERS FOR LOOSE OR DIRTY CONNECTORS. CLEAN OR REPLACE AS REQUIRED. IF PROBLEM PERSISTS, REPLACE RESERVOIR QUANTITY TRANSMITTER (MM29-31-10).
TO SHEET 2

M1-0001-29-400

Hydraulic Fluid Quantity Indication Abnormal
Figure 107 (Sheet 1)

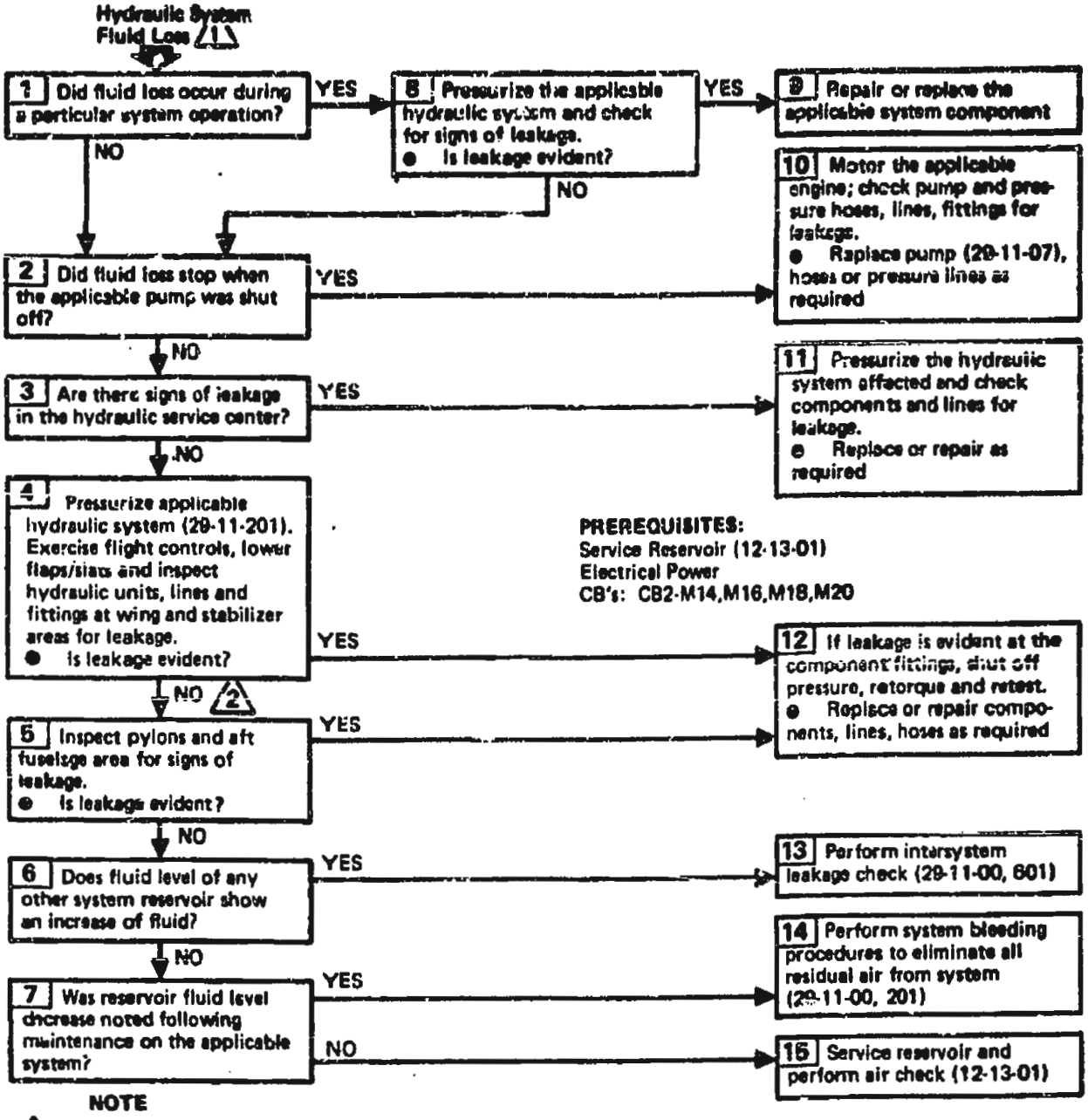
PREREQUISITES
SEE SHEET 1

FROM SHEET 1


1 IS FE/SO PANEL FLUID LEVEL INDICATING HIGH OR LOW?
HIGH
LOW
3 CHECK RESERVOIR QUANTITY GAGE ON HYDRAULIC SERVICE PANEL. IS INDICATION SAME AS FE/SO PANEL GAGE?
NO
YES
6 AT FE/SO PANEL, SNAP INDICATORS. IF FAULT DOES NOT MOVE TO OTHER INDICATOR REPLACE FAULTED INDICATOR (MM29-31-11). IF FAULT PERSISTS, REPLACE RESERVOIR QUANTITY TRANSMITTER (MM29-31-10).
2 DOES RESERVOIR DIRECT-READING GAGE INDICATE SAME QUANTITY?
NO
YES
4 CHECK RESERVOIR SELECTOR SWITCH ON HYDRAULIC SERVICE PANEL, ZONE 147. IS SWITCH FAULTY?
NO
YES
7 REPLACE HYDRAULIC FLUID QUANTITY TRANSMITTER (MM28-31-10). IF PROBLEM PERSISTS, PERFORM HYDRAULIC INDICATING SYSTEM ADJUSTMENT AND TEST (MM29-31-00).
8 REPLACE RESERVOIR SELECTOR SWITCH. IF FAULT PERSISTS, REPLACE HYDRAULIC FULID QUANTITY TRANSMITTER (MM29-31-10).
5 DOES ANY OTHER RESERVOIR QUANTITY INDICATE HIGH?
YES
NO
9 PERFORM HYDRAULIC POWER SYSTEM INTER SYSTEM LEAKAGE CHECK (MM29-11-00, 601).
10 SERVICE RESERVOIR FLUID LEVEL (MM12-13-10). CHECK FOR EXTERNAL LEAKAGE IF LEVEL WAS LOW (MM29-11-00, 601).

M1-0001-29-401

Hydraulic Fluid Quantity Indication Abnormal
Figure 107 (Sheet 2)

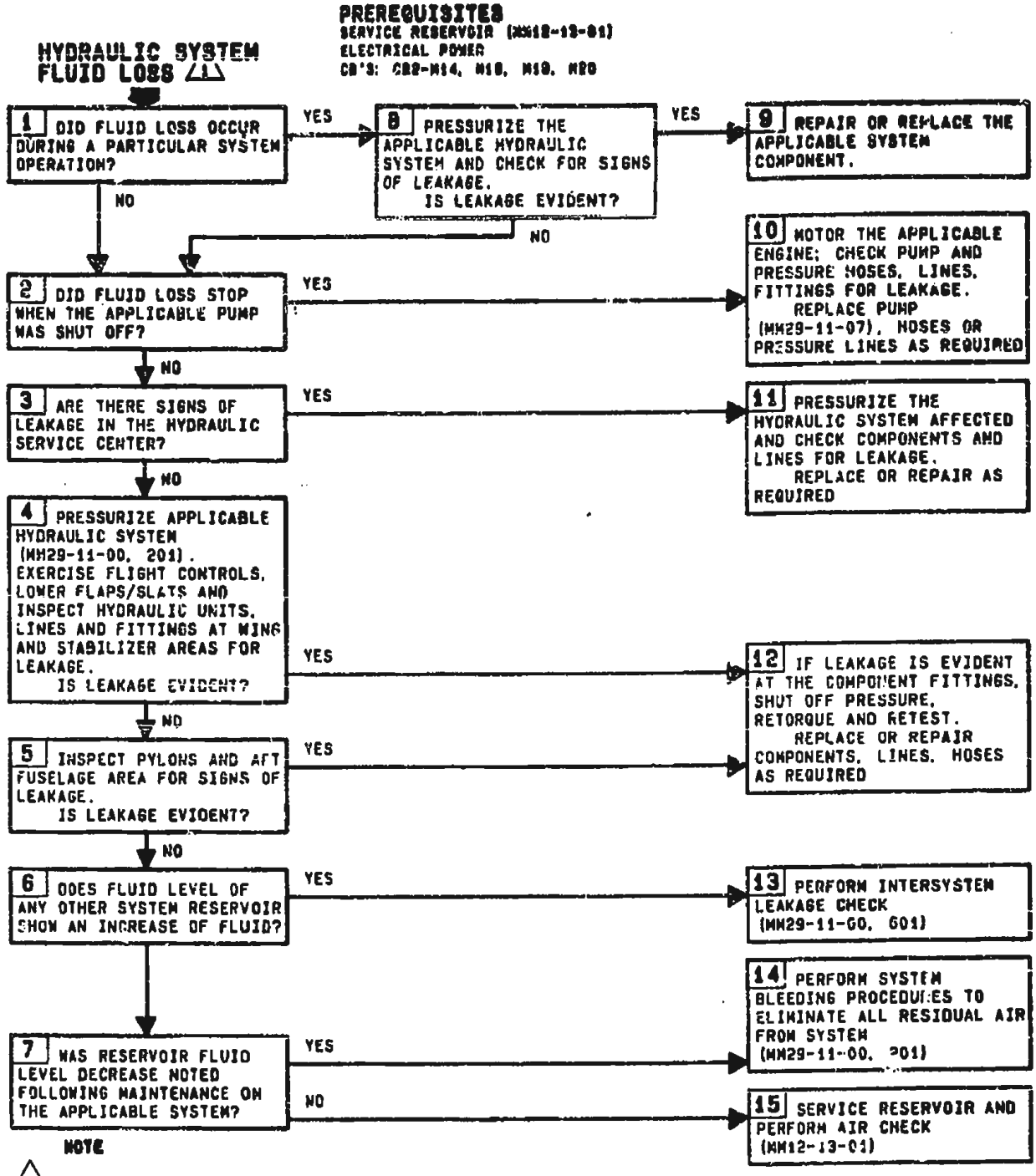

Hydraulic System Fluid Loss (1)
1 Did fluid loss occur during a particular system operation?
YES
8 Pressurize the applicable hydraulic system and check for signs of leakage.
● Is leakage evident?
YES
9 Repair or replace the applicable system component
NO
NO
10 Motor the applicable engine; check pump and pressure hoses, lines, fittings for leakage.
● Replace pump (29-11-07), hoses or pressure lines as required
2 Did fluid loss stop when the applicable pump was shut off?
YES
NO
3 Are there signs of leakage in the hydraulic service center?
YES
11 Pressurize the hydraulic system affected and check components and lines for leakage.
● Replace or repair as required
NO
4 Pressurize applicable hydraulic system (29-11-201). Exercise flight controls, lower flaps/slats and inspect hydraulic units, lines and fittings at wing and stabilizer areas for leakage.
● Is leakage evident?
PREREQUISITES:
Service Reservoir (12-13-01)
Electrical Power
CB's: CB2-M14,M16,M18,M20
YES
12 If leakage is evident at the component fittings, shut off pressure, retorque and retest.
● Replace or repair components, lines, hoses as required
NO (2)
5 Inspect pylons and aft fuselage area for signs of leakage.
● Is leakage evident?
YES
NO
6 Does fluid level of any other system reservoir show an increase of fluid?
YES
13 Perform intersystem leakage check (29-11-00, 601)
NO
7 Was reservoir fluid level decrease noted following maintenance on the applicable system?
YES
14 Perform system bleeding procedures to eliminate all residual air from system (29-11-00, 201)
NO
15 Service reservoir and perform air check (12-13-01)

NOTE

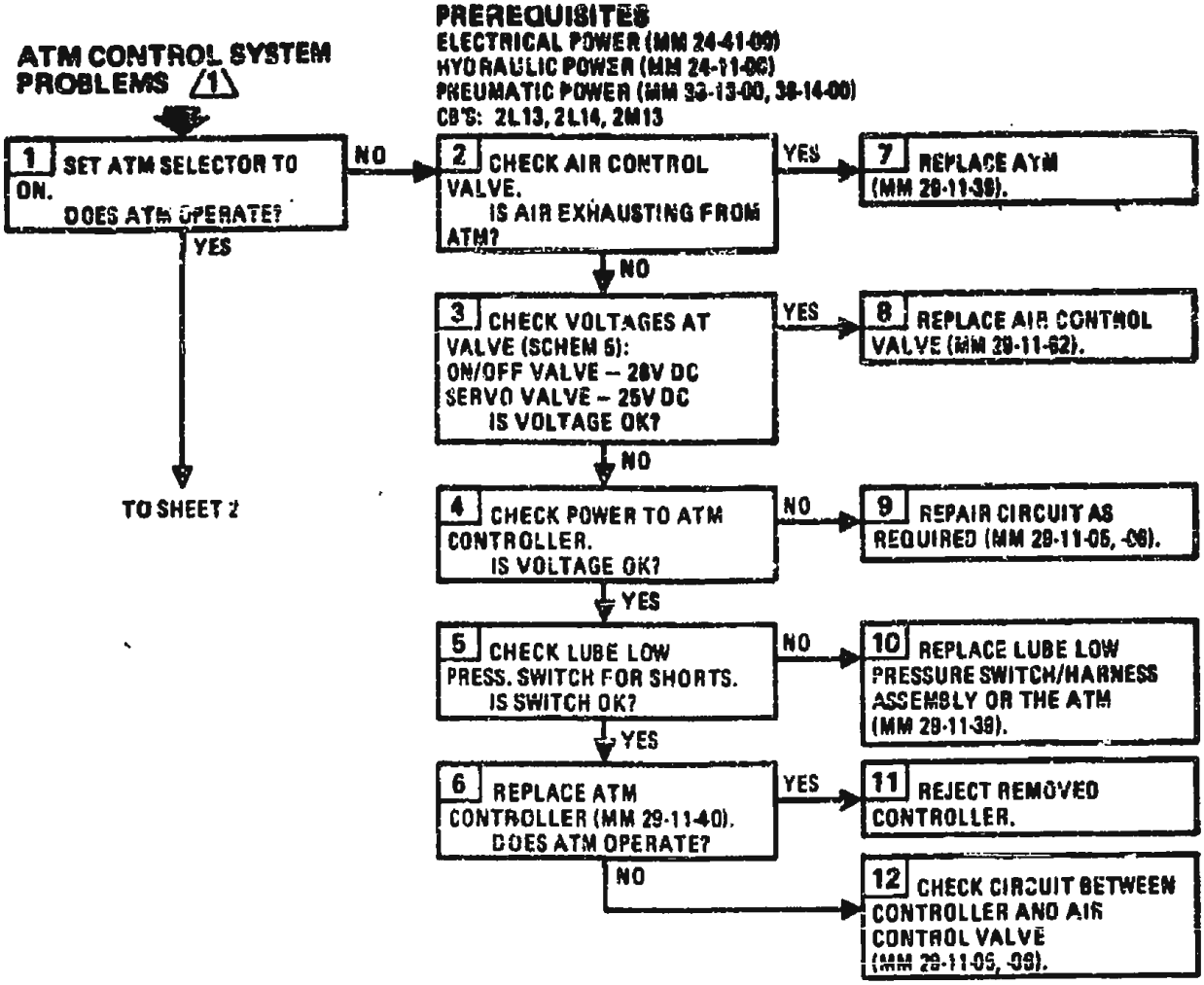
(1) Whenever hydraulic system fluid has been depleted sufficiently to turn on a reservoir low quantity light, any pump being driven (while that light is on) should be replaced as a precautionary measure. Pressure and case drain filters in the affected system must be inspected for contamination and the plumbing flushed if necessary (29-00-00, 201).

(2) If hydraulic fluid loss is evident in systems A or B, energize applicable system, check rudder mechanical limiter actuators for leaks as follows. In the FESC depress and hold both CADC self test buttons simultaneously until air speed increases past 164 KTS and ±8° light on pilots overhead RUDDER LIMITER panel turns on. Inspect area below rudder for evidence of leakage. Replace leaking component if detected. M1-0103-29-327

Hydraulic System Fluid Loss
Figure 108


PREREQUISITES
SERVICE RESERVOIR (MM12-13-01)
ELECTRICAL POWER
CB'S: C22-M14, M18, M19, M20
HYDRAULIC SYSTEM FLUID LOSS
1 DID FLUID LOSS OCCUR DURING A PARTICULAR SYSTEM OPERATION?
YES
8 PRESSURIZE THE APPLICABLE HYDRAULIC SYSTEM AND CHECK FOR SIGNS OF LEAKAGE. IS LEAKAGE EVIDENT?
YES
9 REPAIR OR REPLACE THE APPLICABLE SYSTEM COMPONENT.
NO
NO
10 MOTOR THE APPLICABLE ENGINE; CHECK PUMP AND PRESSURE HOSES, LINES, FITTINGS FOR LEAKAGE. REPLACE PUMP (MM29-11-07), HOSES OR PRESSURE LINES AS REQUIRED
2 DID FLUID LOSS STOP WHEN THE APPLICABLE PUMP WAS SHUT OFF?
YES
NO
3 ARE THERE SIGNS OF LEAKAGE IN THE HYDRAULIC SERVICE CENTER?
YES
11 PRESSURIZE THE HYDRAULIC SYSTEM AFFECTED AND CHECK COMPONENTS AND LINES FOR LEAKAGE. REPLACE OR REPAIR AS REQUIRED
NO
4 PRESSURIZE APPLICABLE HYDRAULIC SYSTEM (MM29-11-00, 201). EXERCISE FLIGHT CONTROLS, LOWER FLAPS/SLATS AND INSPECT HYDRAULIC UNITS, LINES AND FITTINGS AT WING AND STABILIZER AREAS FOR LEAKAGE. IS LEAKAGE EVIDENT?
YES
12 IF LEAKAGE IS EVIDENT AT THE COMPONENT FITTINGS, SHUT OFF PRESSURE, RETORQUE AND RETEST. REPLACE OR REPAIR COMPONENTS, LINES, HOSES AS REQUIRED
NO
5 INSPECT PYLONS AND AFT FUSELAGE AREA FOR SIGNS OF LEAKAGE. IS LEAKAGE EVIDENT?
YES
NO
6 DOES FLUID LEVEL OF ANY OTHER SYSTEM RESERVOIR SHOW AN INCREASE OF FLUID?
YES
13 PERFORM INTERSYSTEM LEAKAGE CHECK (MM29-11-00, 501)
14 PERFORM SYSTEM BLEEDING PROCEDURES TO ELIMINATE ALL RESIDUAL AIR FROM SYSTEM (MM29-11-00, 201)
7 WAS RESERVOIR FLUID LEVEL DECREASE NOTED FOLLOWING MAINTENANCE ON THE APPLICABLE SYSTEM?
YES
NO
15 SERVICE RESERVOIR AND PERFORM AIR CHECK (MM12-13-01)
NOTE
1 WHENEVER HYDRAULIC SYSTEM FLUID HAS BEEN DEPLETED SUFFICIENTLY TO TURN ON A RESERVOIR LOW QUANTITY LIGHT, ANY PUMP BEING DRIVEN (WHILE THAT LIGHT IS ON) SHOULD BE REPLACED AS A PRECAUTIONARY MEASURE. PRESSURE AND CASE DRAIN FILTERS IN THE AFFECTED SYSTEM MUST BE INSPECTED FOR CONTAMINATION AND THE PLUMBING FLUSHED IF NECESSARY (29-00-00, 201).
M1-0000-99-004

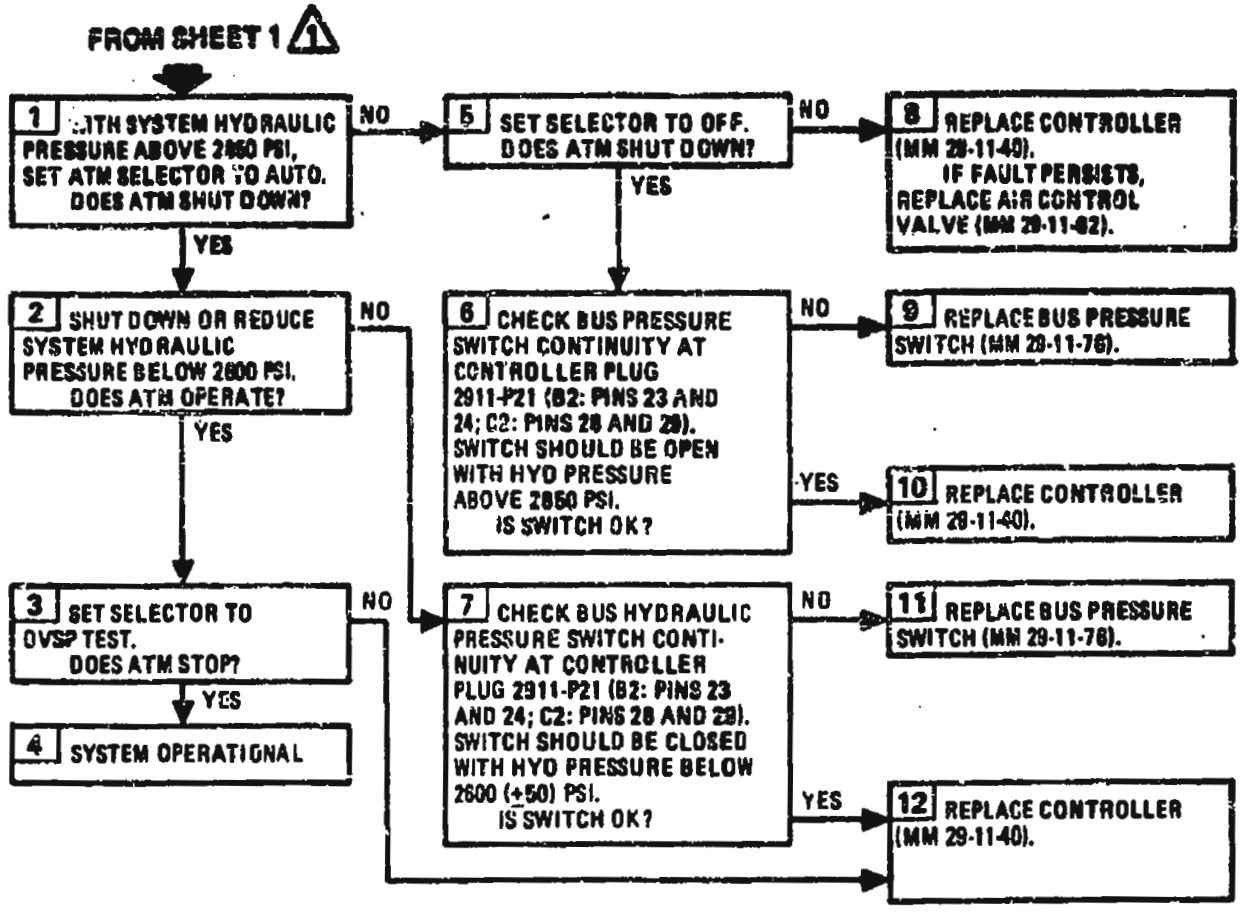
Hydraulic System Fluid Loss
Figure 108


ATM CONTROL SYSTEM PROBLEMS /1\
PREREQUISITES
ELECTRICAL POWER (MM 24-41-00)
HYDRAULIC POWER (MM 24-11-00)
PNEUMATIC POWER (MM 33-13-00, 36-14-00)
CB'S: 2L13, 2L14, 2M13
1 SET ATM SELECTOR TO ON. DOES ATM OPERATE?
NO
YES
TO SHEET 2
2 CHECK AIR CONTROL VALVE. IS AIR EXHAUSTING FROM ATM?
YES
7 REPLACE ATM (MM 29-11-39).
NO
3 CHECK VOLTAGES AT VALVE (SCHEM 5): ON/OFF VALVE – 28V DC SERVO VALVE – 25V DC IS VOLTAGE OK?
YES
8 REPLACE AIR CONTROL VALVE (MM 29-11-62).
NO
4 CHECK POWER TO ATM CONTROLLER. IS VOLTAGE OK?
NO
9 REPAIR CIRCUIT AS REQUIRED (MM 29-11-05, -06).
YES
5 CHECK LUBE LOW PRESS. SWITCH FOR SHORTS. IS SWITCH OK?
NO
10 REPLACE LUBE LOW PRESSURE SWITCH/HARNESS ASSEMBLY OR THE ATM (MM 29-11-39).
YES
6 REPLACE ATM CONTROLLER (MM 29-11-40). DOES ATM OPERATE?
YES
11 REJECT REMOVED CONTROLLER.
NO
12 CHECK CIRCUIT BETWEEN CONTROLLER AND AIR CONTROL VALVE (MM 29-11-05, -09).

/1\ **NOTE**
DO NOT PULL (OPEN) CIRCUIT BREAKER ATM PUMP & IND SYS (CB 2L13) FOLLOWING ATM FAILURE AS CIRCUIT BREAKER SUPPLIES POWER FOR OPERATION OF THE HYDRAULIC SYSTEM ANNUNCIATOR LIGHTS ON PILOTS INSTRUMENT PANEL

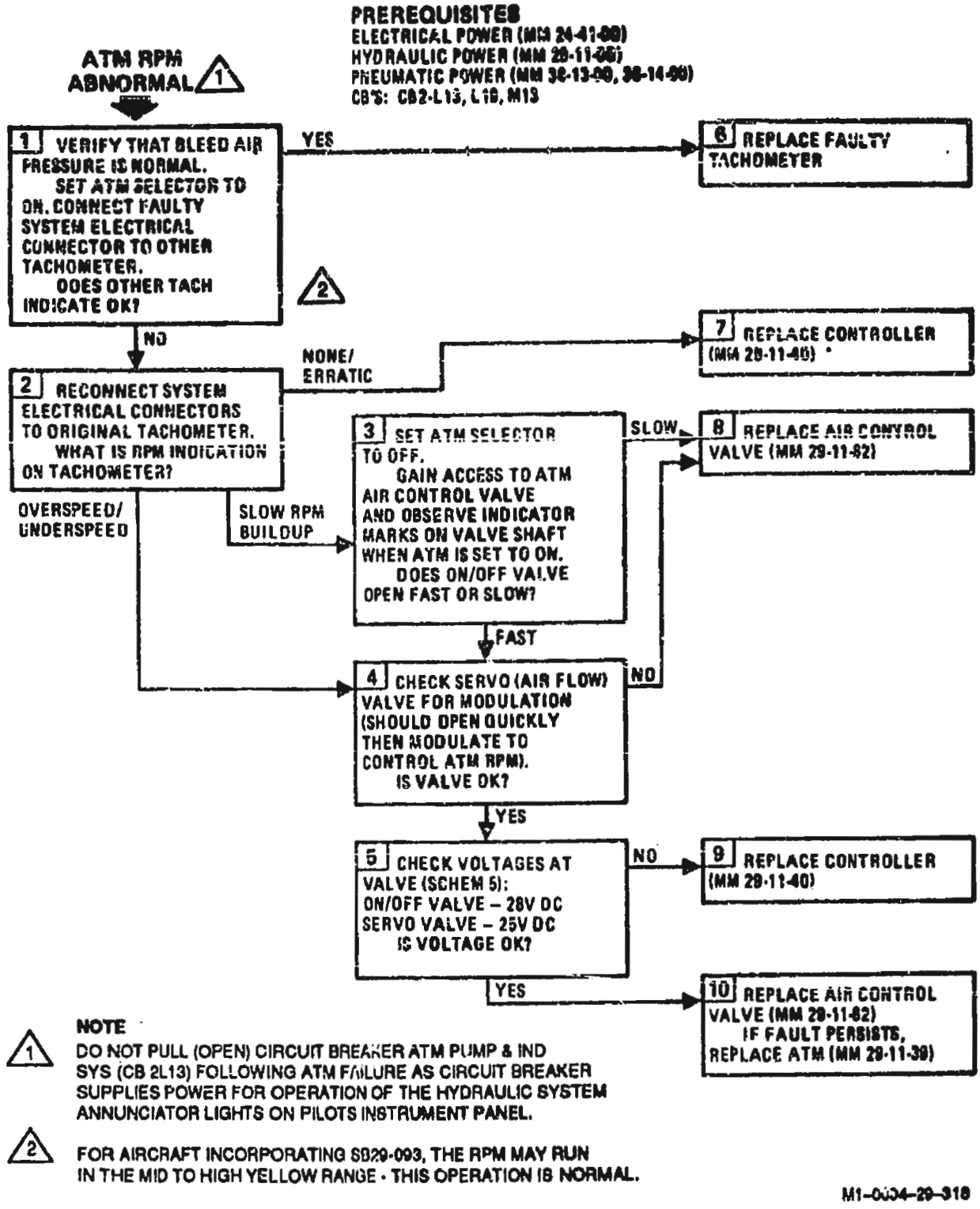
M1–0003–29–317

ATM Control System Problems
Figure 109 (Sheet 1)


FROM SHEET 1 (1)
1 WITH SYSTEM HYDRAULIC PRESSURE ABOVE 2850 PSI, SET ATM SELECTOR TO AUTO. DOES ATM SHUT DOWN?
NO
5 SET SELECTOR TO OFF. DOES ATM SHUT DOWN?
NO
8 REPLACE CONTROLLER (MM 29-11-40). IF FAULT PERSISTS, REPLACE AIR CONTROL VALVE (MM 29-11-62).
YES
YES
2 SHUT DOWN OR REDUCE SYSTEM HYDRAULIC PRESSURE BELOW 2600 PSI. DOES ATM OPERATE?
NO
6 CHECK BUS PRESSURE SWITCH CONTINUITY AT CONTROLLER PLUG 2911-P21 (B2: PINS 23 AND 24; C2: PINS 28 AND 29). SWITCH SHOULD BE OPEN WITH HYD PRESSURE ABOVE 2850 PSI. IS SWITCH OK?
NO
9 REPLACE BUS PRESSURE SWITCH (MM 29-11-76).
YES
YES
10 REPLACE CONTROLLER (MM 29-11-40).
3 SET SELECTOR TO OVSP TEST. DOES ATM STOP?
NO
7 CHECK BUS HYDRAULIC PRESSURE SWITCH CONTINUITY AT CONTROLLER PLUG 2911-P21 (B2: PINS 23 AND 24; C2: PINS 28 AND 29). SWITCH SHOULD BE CLOSED WITH HYD PRESSURE BELOW 2600 (±50) PSI. IS SWITCH OK?
NO
11 REPLACE BUS PRESSURE SWITCH (MM 29-11-76).
YES
YES
4 SYSTEM OPERATIONAL
YES
12 REPLACE CONTROLLER (MM 29-11-40).

M1-0000-29-029

ATM Control System Problems
Figure 109 (Sheet 2)


PREREQUISITES
ELECTRICAL POWER (MM 24-41-00)
HYDRAULIC POWER (MM 29-11-00)
PNEUMATIC POWER (MM 36-13-00, 36-14-00)
CB'S: CB2-L13, L16, M13
ATM RPM ABNORMAL 1
1 VERIFY THAT BLEED AIR PRESSURE IS NORMAL. SET ATM SELECTOR TO ON. CONNECT FAULTY SYSTEM ELECTRICAL CONNECTOR TO OTHER TACHOMETER. DOES OTHER TACH INDICATE OK?
YES
6 REPLACE FAULTY TACHOMETER
2
NO
2 RECONNECT SYSTEM ELECTRICAL CONNECTORS TO ORIGINAL TACHOMETER. WHAT IS RPM INDICATION ON TACHOMETER?
NONE/ ERRATIC
7 REPLACE CONTROLLER (MM 29-11-40)
OVERSPEED/ UNDERSPEED
SLOW RPM BUILDUP
3 SET ATM SELECTOR TO OFF. GAIN ACCESS TO ATM AIR CONTROL VALVE AND OBSERVE INDICATOR MARKS ON VALVE SHAFT WHEN ATM IS SET TO ON. DOES ON/OFF VALVE OPEN FAST OR SLOW?
SLOW
8 REPLACE AIR CONTROL VALVE (MM 29-11-82)
FAST
4 CHECK SERVO (AIR FLOW) VALVE FOR MODULATION (SHOULD OPEN QUICKLY THEN MODULATE TO CONTROL ATM RPM). IS VALVE OK?
NO
YES
5 CHECK VOLTAGES AT VALVE (SCHEM 5): ON/OFF VALVE – 28V DC SERVO VALVE – 25V DC IS VOLTAGE OK?
NO
9 REPLACE CONTROLLER (MM 29-11-40)
YES
10 REPLACE AIR CONTROL VALVE (MM 29-11-82) IF FAULT PERSISTS, REPLACE ATM (MM 29-11-39)

NOTE

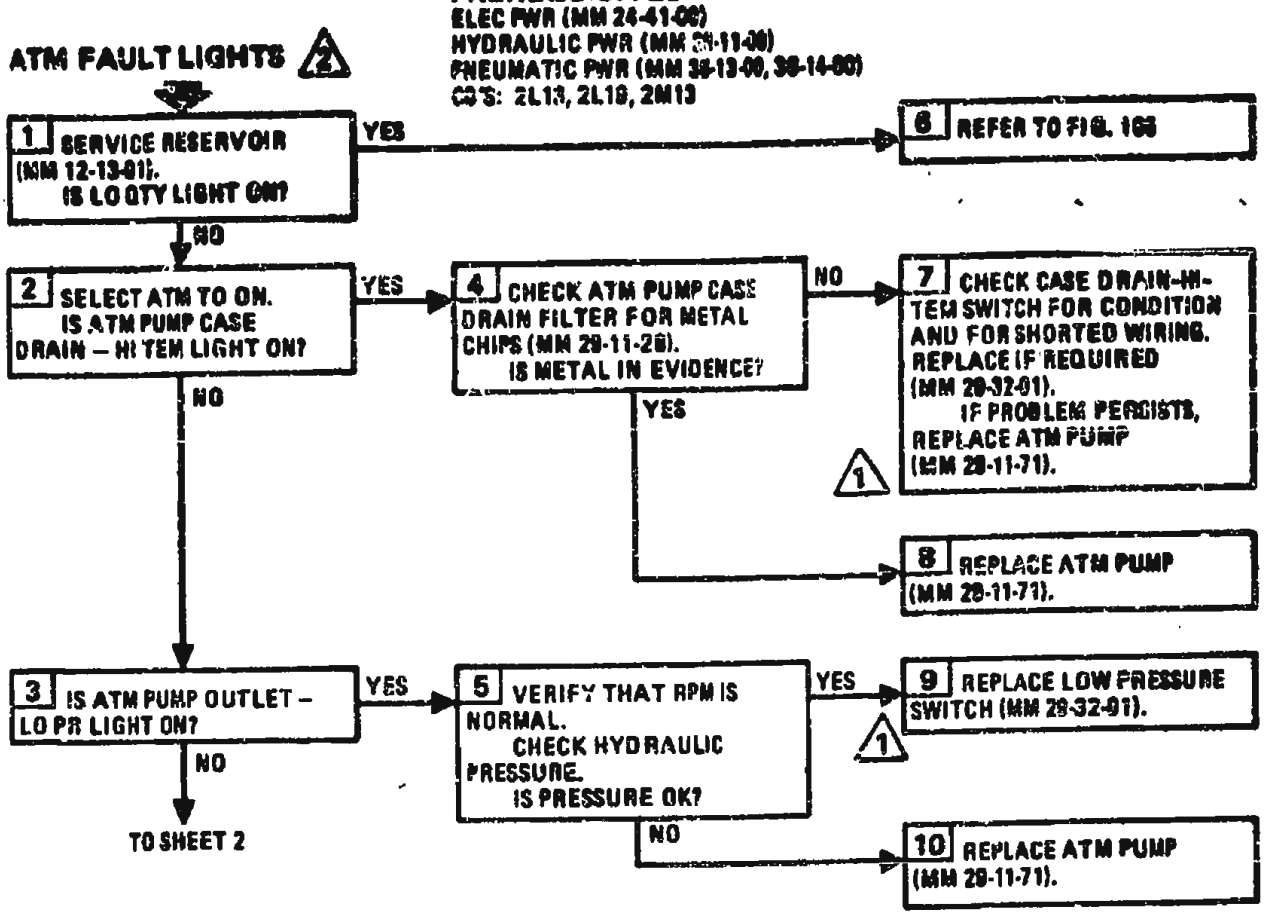
1 DO NOT PULL (OPEN) CIRCUIT BREAKER ATM PUMP & IND SYS (CB 2L13) FOLLOWING ATM FAILURE AS CIRCUIT BREAKER SUPPLIES POWER FOR OPERATION OF THE HYDRAULIC SYSTEM ANNUNCIATOR LIGHTS ON PILOTS INSTRUMENT PANEL.

2 FOR AIRCRAFT INCORPORATING SB29-093, THE RPM MAY RUN IN THE MID TO HIGH YELLOW RANGE - THIS OPERATION IS NORMAL.

M1-0004-29-318

R R ATM RPM Abnormal
Figure 110

PREREQUISITES
ELEC PWR (MM 24-41-00)
HYDRAULIC PWR (MM 29-11-00)
PNEUMATIC PWR (MM 36-13-00, 36-14-00)
CBS: 2L13, 2L19, 2M13

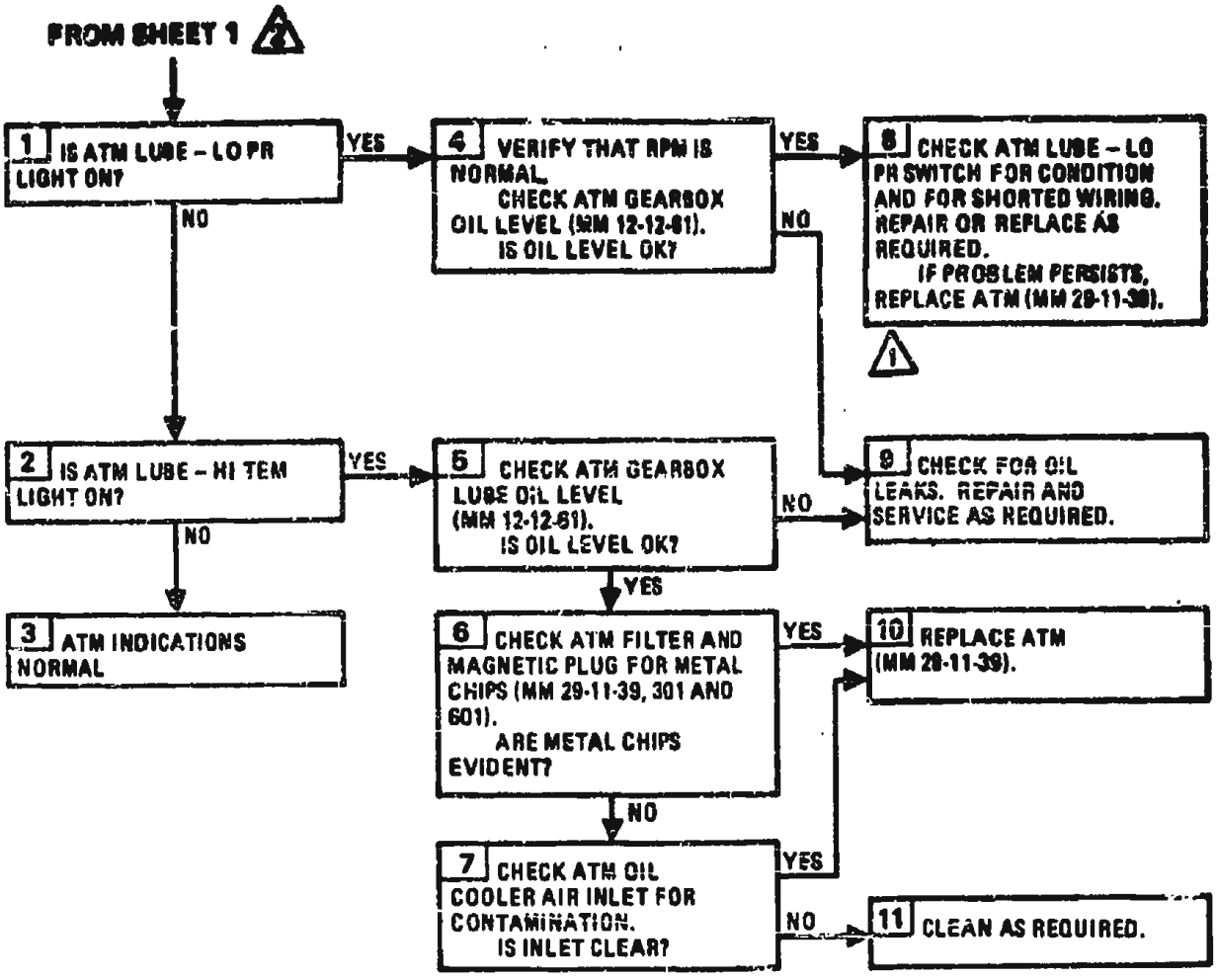

ATM FAULT LIGHTS
2
1 SERVICE RESERVOIR (MM 12-13-01). IS LO QTY LIGHT ON?
YES
6 REFER TO FIG. 106
NO
2 SELECT ATM TO ON. IS ATM PUMP CASE DRAIN – HI TEM LIGHT ON?
YES
4 CHECK ATM PUMP CASE DRAIN FILTER FOR METAL CHIPS (MM 29-11-26). IS METAL IN EVIDENCE?
NO
7 CHECK CASE DRAIN-HI-TEM SWITCH FOR CONDITION AND FOR SHORTED WIRING. REPLACE IF REQUIRED (MM 29-32-01). IF PROBLEM PERSISTS, REPLACE ATM PUMP (MM 29-11-71).
1
YES
8 REPLACE ATM PUMP (MM 29-11-71).
NO
3 IS ATM PUMP OUTLET – LO PR LIGHT ON?
YES
5 VERIFY THAT RPM IS NORMAL. CHECK HYDRAULIC PRESSURE. IS PRESSURE OK?
YES
9 REPLACE LOW PRESSURE SWITCH (MM 29-32-01).
1
NO
TO SHEET 2
NO
10 REPLACE ATM PUMP (MM 29-11-71).

1 NOTE
ATM TEMP AND LUBE LO PR SWITCHES ARE INTEGRAL WITH ATM HARNESS ASSEMBLY

2 DO NOT PULL (OPEN CIRCUIT BREAKER ATM PUMP & IND SYS (CB 2L13) FOLLOWING ATM FAILURE AS CIRCUIT BREAKER SUPPLIES POWER FOR OPERATION OF THE HYDRAULIC SYSTEM ANNUNCIATOR LIGHT ON PILOTS INSTRUMENT PANEL

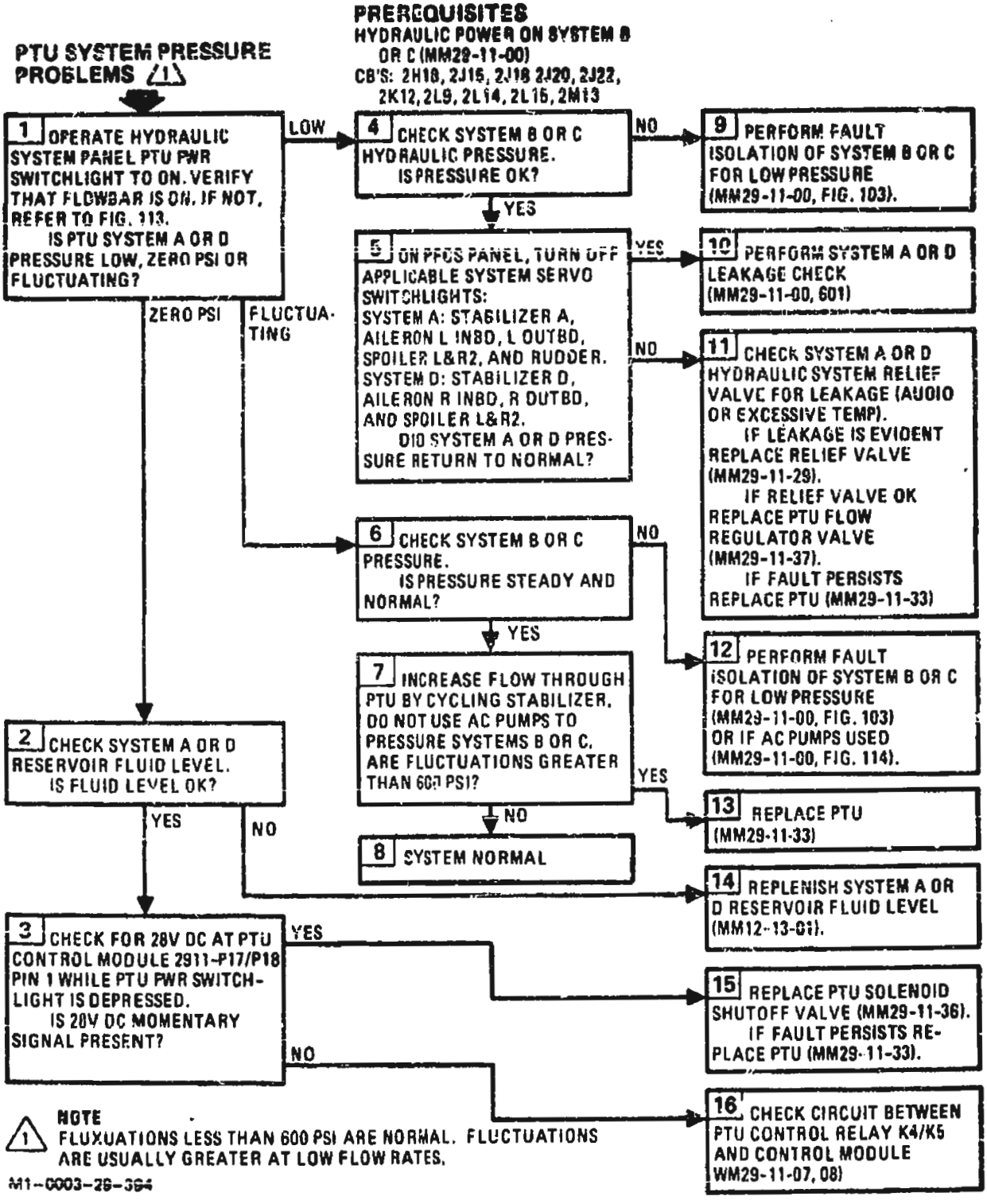
M1-0004-29-319

ATM Fault Lights
Figure 111 (Sheet 1)

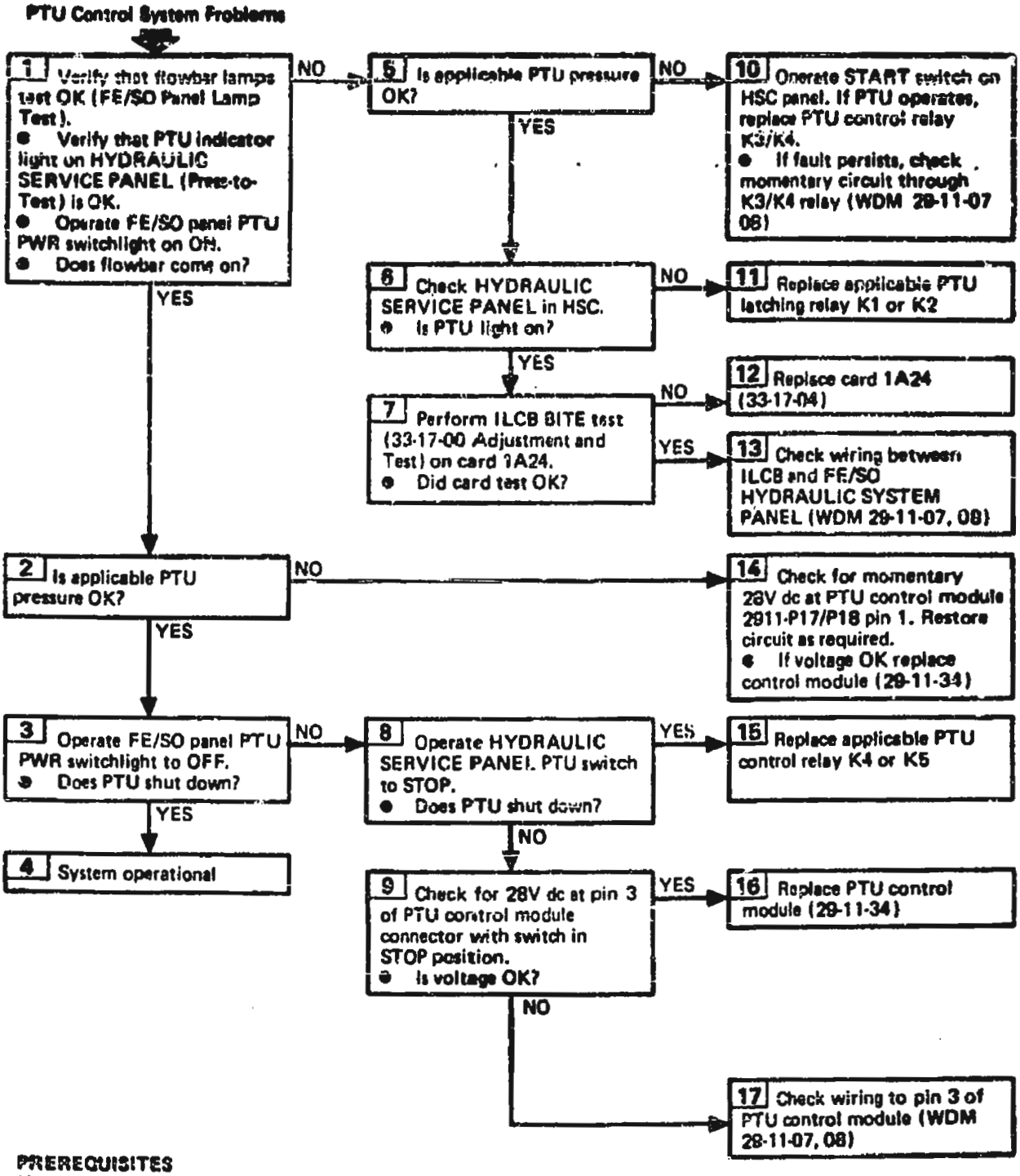

FROM SHEET 1
1 IS ATM LUBE – LO PR LIGHT ON?
YES
NO
2 IS ATM LUBE – HI TEM LIGHT ON?
YES
NO
3 ATM INDICATIONS NORMAL
4 VERIFY THAT RPM IS NORMAL.
CHECK ATM GEARBOX OIL LEVEL (MM 12-12-61).
IS OIL LEVEL OK?
YES
NO
5 CHECK ATM GEARBOX LUBE OIL LEVEL (MM 12-12-61).
IS OIL LEVEL OK?
YES
NO
6 CHECK ATM FILTER AND MAGNETIC PLUG FOR METAL CHIPS (MM 29-11-39, 301 AND 601).
ARE METAL CHIPS EVIDENT?
YES
NO
7 CHECK ATM OIL COOLER AIR INLET FOR CONTAMINATION.
IS INLET CLEAR?
YES
NO
8 CHECK ATM LUBE – LO PR SWITCH FOR CONDITION AND FOR SHORTED WIRING. REPAIR OR REPLACE AS REQUIRED.
IF PROBLEM PERSISTS, REPLACE ATM (MM 29-11-39).
9 CHECK FOR OIL LEAKS. REPAIR AND SERVICE AS REQUIRED.
10 REPLACE ATM (MM 29-11-39).
11 CLEAN AS REQUIRED.

M1-0000-29-030

ATM Fault Lights
Figure 111 (Sheet 2)


PTU SYSTEM PRESSURE PROBLEMS (1)
PREREQUISITES
HYDRAULIC POWER ON SYSTEM B OR C (MM29-11-00)
CB'S: 2H18, 2J15, 2J18 2J20, 2J22, 2K12, 2L9, 2L14, 2L15, 2M13
1 OPERATE HYDRAULIC SYSTEM PANEL PTU PWR SWITCHLIGHT TO ON. VERIFY THAT FLOWBAR IS ON. IF NOT, REFER TO FIG. 113.
IS PTU SYSTEM A OR D PRESSURE LOW, ZERO PSI OR FLUCTUATING?
LOW
ZERO PSI
FLUCTUATING
4 CHECK SYSTEM B OR C HYDRAULIC PRESSURE.
IS PRESSURE OK?
NO
9 PERFORM FAULT ISOLATION OF SYSTEM B OR C FOR LOW PRESSURE (MM29-11-00, FIG. 103).
YES
5 ON PFCS PANEL, TURN OFF APPLICABLE SYSTEM SERVO SWITCHLIGHTS:
SYSTEM A: STABILIZER A, AILERON L INBD, L OUTBD, SPOILER L&R2, AND RUDDER.
SYSTEM D: STABILIZER D, AILERON R INBD, R OUTBD, AND SPOILER L&R2.
DID SYSTEM A OR D PRESSURE RETURN TO NORMAL?
YES
10 PERFORM SYSTEM A OR D LEAKAGE CHECK (MM29-11-00, 601)
NO
11 CHECK SYSTEM A OR D HYDRAULIC SYSTEM RELIEF VALVE FOR LEAKAGE (AUDIO OR EXCESSIVE TEMP).
IF LEAKAGE IS EVIDENT REPLACE RELIEF VALVE (MM29-11-29).
IF RELIEF VALVE OK REPLACE PTU FLOW REGULATOR VALVE (MM29-11-37).
IF FAULT PERSISTS REPLACE PTU (MM29-11-33)
6 CHECK SYSTEM B OR C PRESSURE.
IS PRESSURE STEADY AND NORMAL?
NO
YES
7 INCREASE FLOW THROUGH PTU BY CYCLING STABILIZER. DO NOT USE AC PUMPS TO PRESSURE SYSTEMS B OR C. ARE FLUCTUATIONS GREATER THAN 600 PSI?
YES
NO
8 SYSTEM NORMAL
12 PERFORM FAULT ISOLATION OF SYSTEM B OR C FOR LOW PRESSURE (MM29-11-00, FIG. 103) OR IF AC PUMPS USED (MM29-11-00, FIG. 114).
13 REPLACE PTU (MM29-11-33)
2 CHECK SYSTEM A OR D RESERVOIR FLUID LEVEL.
IS FLUID LEVEL OK?
YES
NO
14 REPLENISH SYSTEM A OR D RESERVOIR FLUID LEVEL (MM12-13-01).
3 CHECK FOR 28V DC AT PTU CONTROL MODULE 2911-P17/P18 PIN 1 WHILE PTU PWR SWITCHLIGHT IS DEPRESSED.
IS 28V DC MOMENTARY SIGNAL PRESENT?
YES
NO
15 REPLACE PTU SOLENOID SHUTOFF VALVE (MM29-11-36).
IF FAULT PERSISTS REPLACE PTU (MM29-11-33).
16 CHECK CIRCUIT BETWEEN PTU CONTROL RELAY K4/K5 AND CONTROL MODULE WM29-11-07, 08)
(1) NOTE
FLUXUATIONS LESS THAN 600 PSI ARE NORMAL. FLUCTUATIONS ARE USUALLY GREATER AT LOW FLOW RATES.
M1-0003-28-384

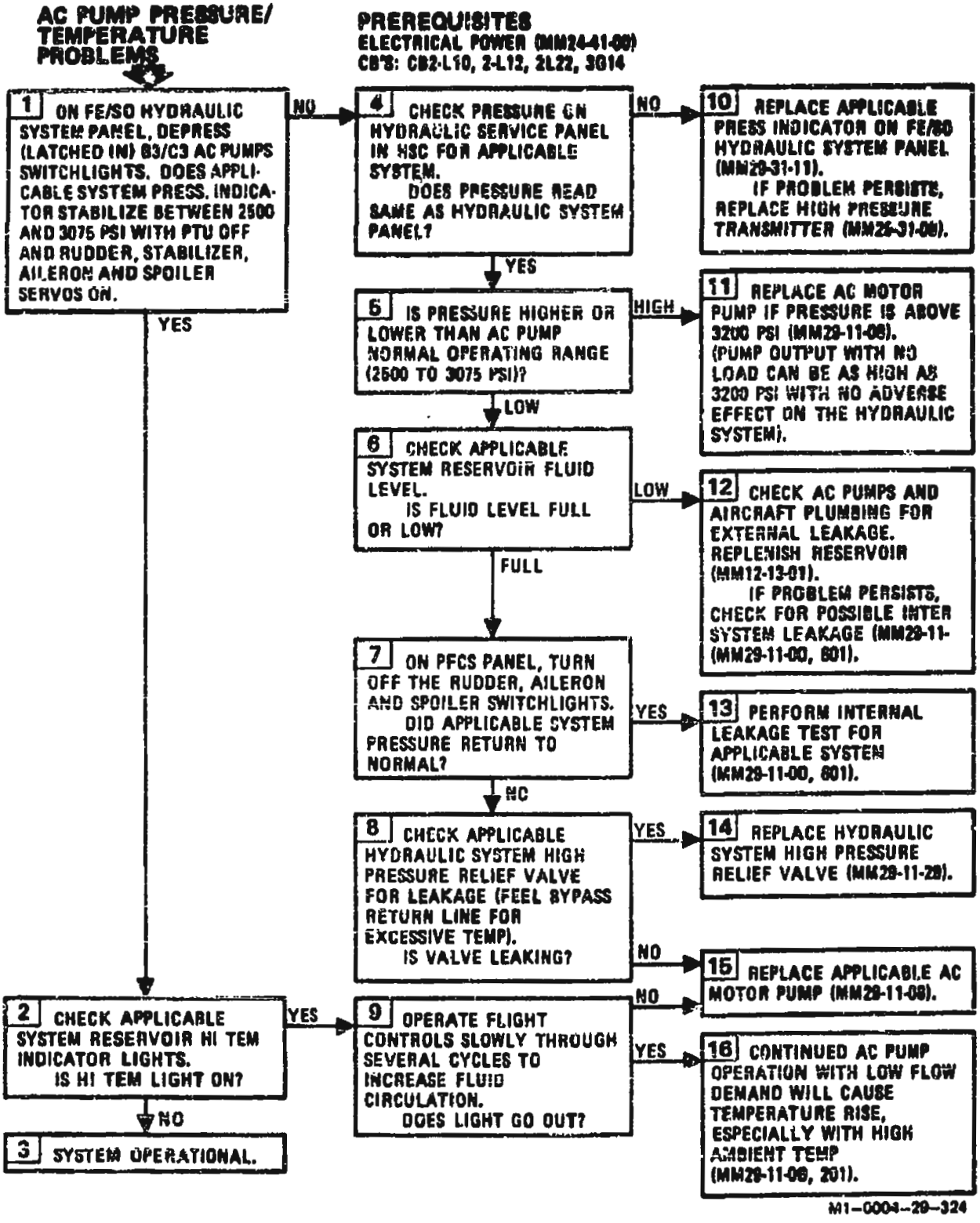
PTU System Pressure Problems
Figure 112


PTU Control System Problems
1 Verify that flowbar lamps test OK (FE/SO Panel Lamp Test).
● Verify that PTU indicator light on HYDRAULIC SERVICE PANEL (Press-to-Test) is OK.
● Operate FE/SO panel PTU PWR switchlight on ON.
● Does flowbar come on?
NO
YES
2 Is applicable PTU pressure OK?
NO
YES
3 Operate FE/SO panel PTU PWR switchlight to OFF.
● Does PTU shut down?
NO
YES
4 System operational
5 Is applicable PTU pressure OK?
NO
YES
6 Check HYDRAULIC SERVICE PANEL in HSC.
● Is PTU light on?
NO
YES
7 Perform ILCB BITE test (33-17-00 Adjustment and Test) on card 1A24.
● Did card test OK?
NO
YES
8 Operate HYDRAULIC SERVICE PANEL PTU switch to STOP.
● Does PTU shut down?
YES
NO
9 Check for 28V dc at pin 3 of PTU control module connector with switch in STOP position.
● Is voltage OK?
YES
NO
10 Operate START switch on HSC panel. If PTU operates, replace PTU control relay K3/K4.
● If fault persists, check momentary circuit through K3/K4 relay (WDM 29-11-07 08)
11 Replace applicable PTU latching relay K1 or K2
12 Replace card 1A24 (33-17-04)
13 Check wiring between ILCB and FE/SO HYDRAULIC SYSTEM PANEL (WDM 29-11-07, 08)
14 Check for momentary 28V dc at PTU control module 2911-P17/P18 pin 1. Restore circuit as required.
● If voltage OK replace control module (29-11-34)
15 Replace applicable PTU control relay K4 or K5
16 Replace PTU control module (29-11-34)
17 Check wiring to pin 3 of PTU control module (WDM 28-11-07, 08)

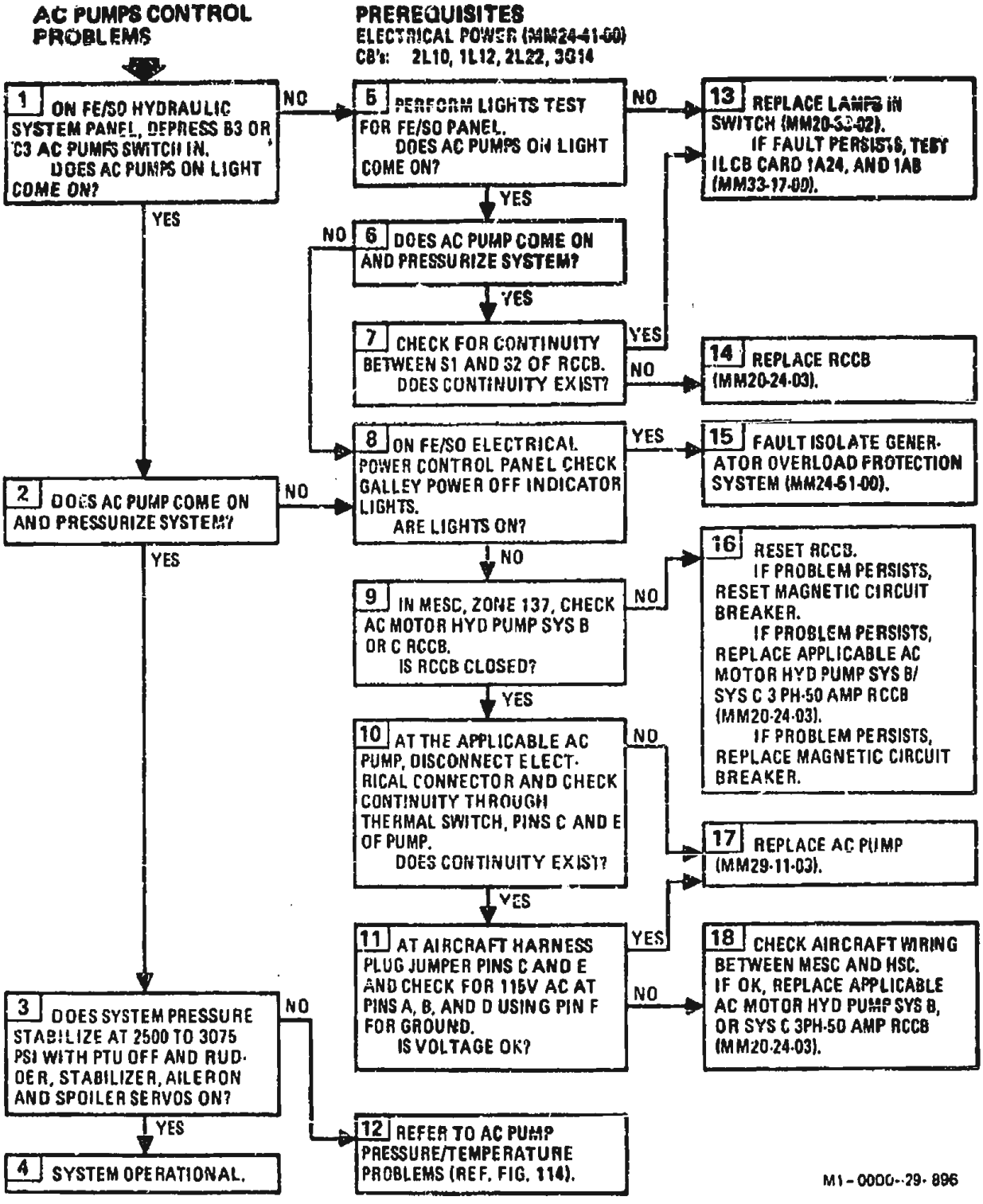
PREREQUISITES
Hydraulic Power on System B or C (29-11-00)
CB's: CB2-H18, J15, 18, 20, 22, K12, L9, 14, 15, M13

M1-0102-29-322

PTU Control System Problems
Figure 113

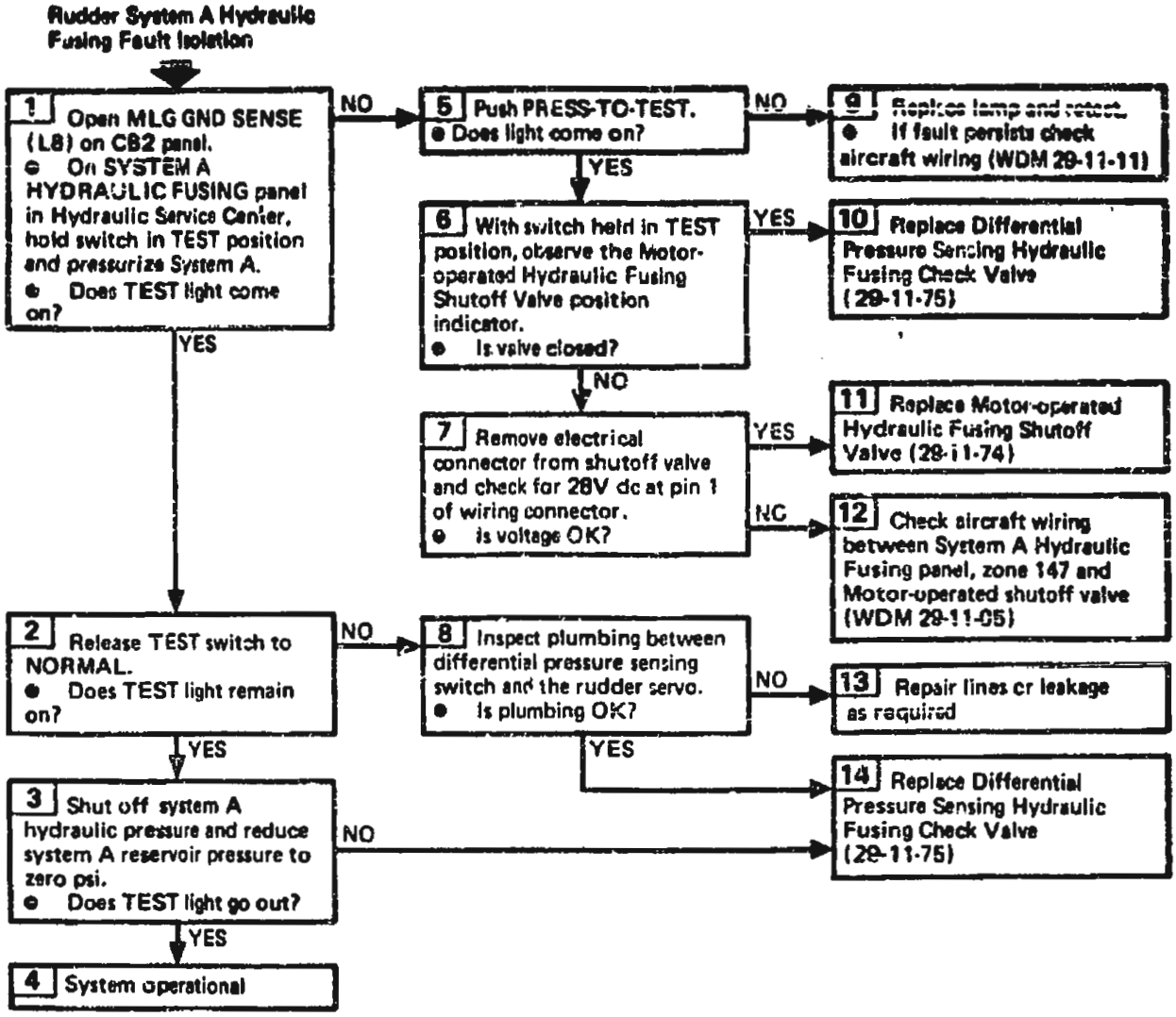

AC PUMP PRESSURE/ TEMPERATURE PROBLEMS
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: CB2-L10, 2-L12, 2L22, 3G14
1 ON FE/SO HYDRAULIC SYSTEM PANEL, DEPRESS (LATCHED IN) B3/C3 AC PUMPS SWITCHLIGHTS. DOES APPLICABLE SYSTEM PRESS. INDICATOR STABILIZE BETWEEN 2500 AND 3075 PSI WITH PTU OFF AND RUDDER, STABILIZER, AILERON AND SPOILER SERVOS ON.
NO
YES
2 CHECK APPLICABLE SYSTEM RESERVOIR HI TEM INDICATOR LIGHTS. IS HI TEM LIGHT ON?
YES
NO
3 SYSTEM OPERATIONAL.
4 CHECK PRESSURE ON HYDRAULIC SERVICE PANEL IN HSC FOR APPLICABLE SYSTEM. DOES PRESSURE READ SAME AS HYDRAULIC SYSTEM PANEL?
NO
YES
10 REPLACE APPLICABLE PRESS INDICATOR ON FE/SO HYDRAULIC SYSTEM PANEL (MM29-31-11). IF PROBLEM PERSISTS, REPLACE HIGH PRESSURE TRANSMITTER (MM29-31-08).
6 IS PRESSURE HIGHER OR LOWER THAN AC PUMP NORMAL OPERATING RANGE (2500 TO 3075 PSI)?
HIGH
LOW
11 REPLACE AC MOTOR PUMP IF PRESSURE IS ABOVE 3200 PSI (MM29-11-08). (PUMP OUTPUT WITH NO LOAD CAN BE AS HIGH AS 3200 PSI WITH NO ADVERSE EFFECT ON THE HYDRAULIC SYSTEM).
6 CHECK APPLICABLE SYSTEM RESERVOIR FLUID LEVEL. IS FLUID LEVEL FULL OR LOW?
LOW
FULL
12 CHECK AC PUMPS AND AIRCRAFT PLUMBING FOR EXTERNAL LEAKAGE. REPLENISH RESERVOIR (MM12-13-01). IF PROBLEM PERSISTS, CHECK FOR POSSIBLE INTER SYSTEM LEAKAGE (MM29-11-(MM29-11-00, 801).
7 ON PFCS PANEL, TURN OFF THE RUDDER, AILERON AND SPOILER SWITCHLIGHTS. DID APPLICABLE SYSTEM PRESSURE RETURN TO NORMAL?
YES
NO
13 PERFORM INTERNAL LEAKAGE TEST FOR APPLICABLE SYSTEN (MM29-11-00, 801).
8 CHECK APPLICABLE HYDRAULIC SYSTEM HIGH PRESSURE RELIEF VALVE FOR LEAKAGE (FEEL BYPASS RETURN LINE FOR EXCESSIVE TEMP). IS VALVE LEAKING?
YES
NO
14 REPLACE HYDRAULIC SYSTEM HIGH PRESSURE RELIEF VALVE (MM29-11-29).
9 OPERATE FLIGHT CONTROLS SLOWLY THROUGH SEVERAL CYCLES TO INCREASE FLUID CIRCULATION. DOES LIGHT GO OUT?
NO
YES
15 REPLACE APPLICABLE AC MOTOR PUMP (MM29-11-08).
16 CONTINUED AC PUMP OPERATION WITH LOW FLOW DEMAND WILL CAUSE TEMPERATURE RISE, ESPECIALLY WITH HIGH AMBIENT TEMP (MM29-11-08, 201).
M1-0004-29-324

AC Pumps Pressure/Temperature Problems
Figure 114


AC PUMPS CONTROL PROBLEMS
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB's: 2L10, 1L12, 2L22, 3G14
1 ON FE/SO HYDRAULIC SYSTEM PANEL, DEPRESS B3 OR C3 AC PUMPS SWITCH IN. DOES AC PUMPS ON LIGHT COME ON?
NO
YES
2 DOES AC PUMP COME ON AND PRESSURIZE SYSTEM?
NO
YES
3 DOES SYSTEM PRESSURE STABILIZE AT 2500 TO 3075 PSI WITH PTU OFF AND RUDDER, STABILIZER, AILERON AND SPOILER SERVOS ON?
NO
YES
4 SYSTEM OPERATIONAL.
5 PERFORM LIGHTS TEST FOR FE/SO PANEL. DOES AC PUMPS ON LIGHT COME ON?
NO
YES
13 REPLACE LAMPS IN SWITCH (MM20-33-02). IF FAULT PERSISTS, TEST ILCB CARD 1A24, AND 1A8 (MM33-17-00).
6 DOES AC PUMP COME ON AND PRESSURIZE SYSTEM?
NO
YES
7 CHECK FOR CONTINUITY BETWEEN S1 AND S2 OF RCCB. DOES CONTINUITY EXIST?
YES
NO
14 REPLACE RCCB (MM20-24-03).
8 ON FE/SO ELECTRICAL POWER CONTROL PANEL CHECK GALLEY POWER OFF INDICATOR LIGHTS. ARE LIGHTS ON?
YES
15 FAULT ISOLATE GENERATOR OVERLOAD PROTECTION SYSTEM (MM24-51-00).
NO
9 IN MESC, ZONE 137, CHECK AC MOTOR HYD PUMP SYS B OR C RCCB. IS RCCB CLOSED?
NO
16 RESET RCCB. IF PROBLEM PERSISTS, RESET MAGNETIC CIRCUIT BREAKER. IF PROBLEM PERSISTS, REPLACE APPLICABLE AC MOTOR HYD PUMP SYS B/SYS C 3 PH-50 AMP RCCB (MM20-24-03). IF PROBLEM PERSISTS, REPLACE MAGNETIC CIRCUIT BREAKER.
YES
10 AT THE APPLICABLE AC PUMP, DISCONNECT ELECTRICAL CONNECTOR AND CHECK CONTINUITY THROUGH THERMAL SWITCH, PINS C AND E OF PUMP. DOES CONTINUITY EXIST?
NO
17 REPLACE AC PUMP (MM29-11-03).
YES
11 AT AIRCRAFT HARNESS PLUG JUMPER PINS C AND E AND CHECK FOR 115V AC AT PINS A, B, AND D USING PIN F FOR GROUND. IS VOLTAGE OK?
YES
NO
18 CHECK AIRCRAFT WIRING BETWEEN MESC AND HSC. IF OK, REPLACE APPLICABLE AC MOTOR HYD PUMP SYS B, OR SYS C 3PH-50 AMP RCCB (MM20-24-03).
12 REFER TO AC PUMP PRESSURE/TEMPERATURE PROBLEMS (REF. FIG. 114).
M1-0000-29-896

AC Pumps Control Problems
Figure 115

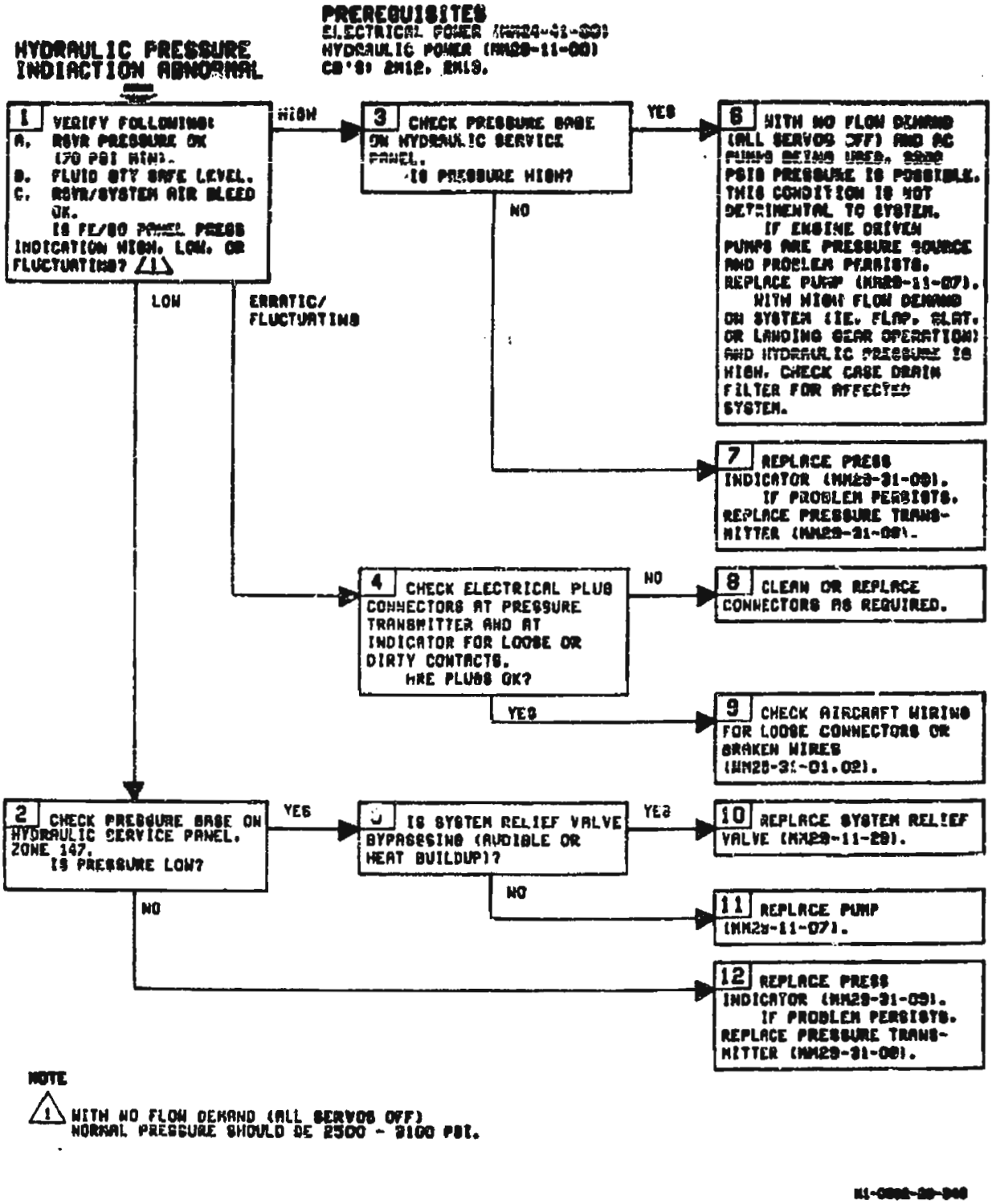
R EFFECTIVITY: ALL
R
001B


Rudder System A Hydraulic Fusing Fault Isolation
1 Open MLG GND SENSE (L8) on CB2 panel.
● On SYSTEM A HYDRAULIC FUSING panel in Hydraulic Service Center, hold switch in TEST position and pressurize System A.
● Does TEST light come on?
NO
YES
5 Push PRESS-TO-TEST.
● Does light come on?
NO
YES
9 Replace lamp and retest.
● If fault persists check aircraft wiring (WDM 29-11-11)
6 With switch held in TEST position, observe the Motor-operated Hydraulic Fusing Shutoff Valve position indicator.
● Is valve closed?
YES
10 Replace Differential Pressure Sensing Hydraulic Fusing Check Valve (29-11-75)
NO
7 Remove electrical connector from shutoff valve and check for 28V dc at pin 1 of wiring connector.
● Is voltage OK?
YES
11 Replace Motor-operated Hydraulic Fusing Shutoff Valve (29-11-74)
NO
12 Check aircraft wiring between System A Hydraulic Fusing panel, zone 147 and Motor-operated shutoff valve (WDM 29-11-05)
2 Release TEST switch to NORMAL.
● Does TEST light remain on?
NO
YES
8 Inspect plumbing between differential pressure sensing switch and the rudder servo.
● Is plumbing OK?
NO
13 Repair lines or leakage as required
YES
14 Replace Differential Pressure Sensing Hydraulic Fusing Check Valve (29-11-75)
3 Shut off system A hydraulic pressure and reduce system A reservoir pressure to zero psi.
● Does TEST light go out?
NO
YES
4 System operational

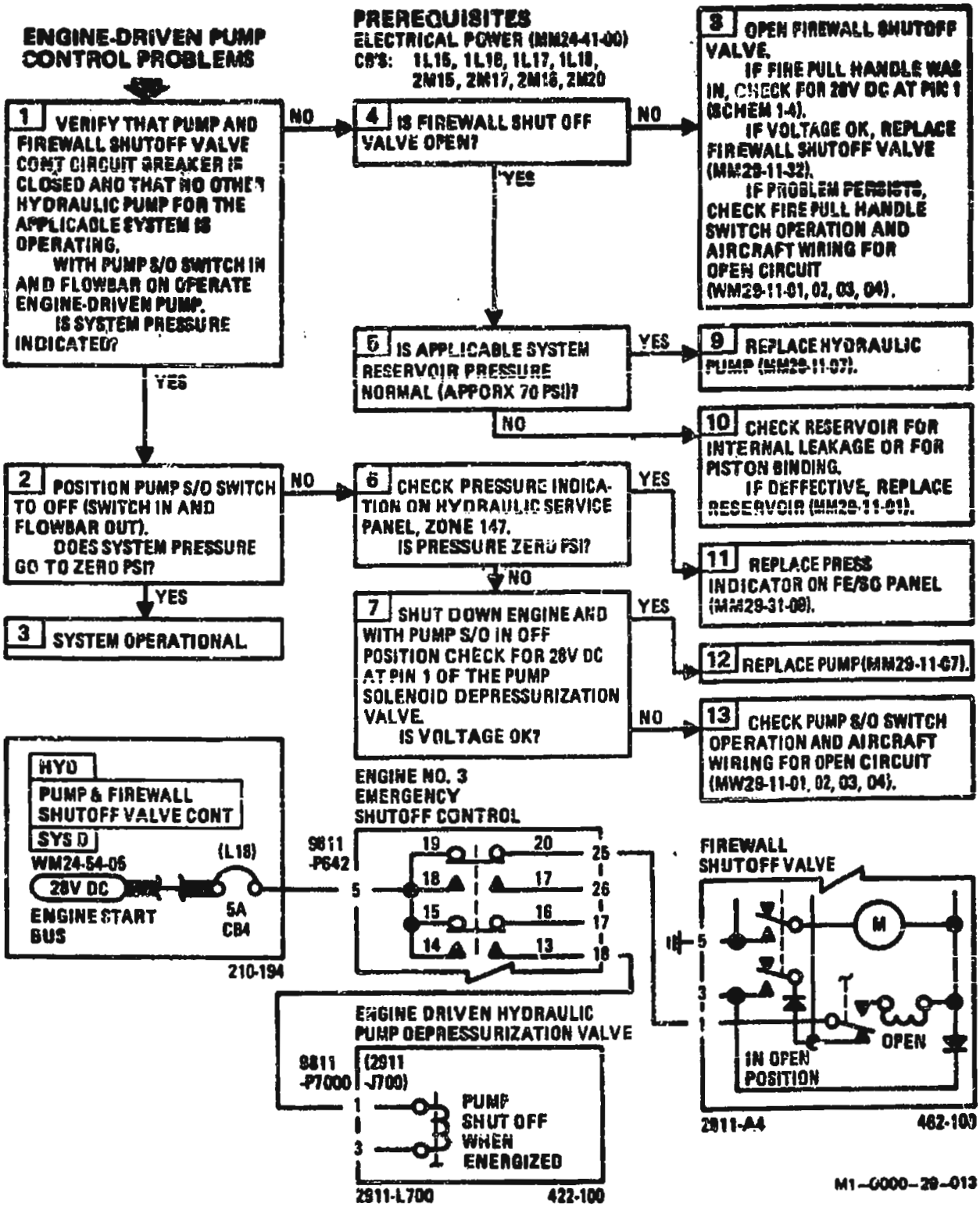
PREREQUISITES
Electric Power (24-41-00)
Hydraulic Power (29-11-00)
CB's: CB2-L16, M12, M13

M1-0103-29-843

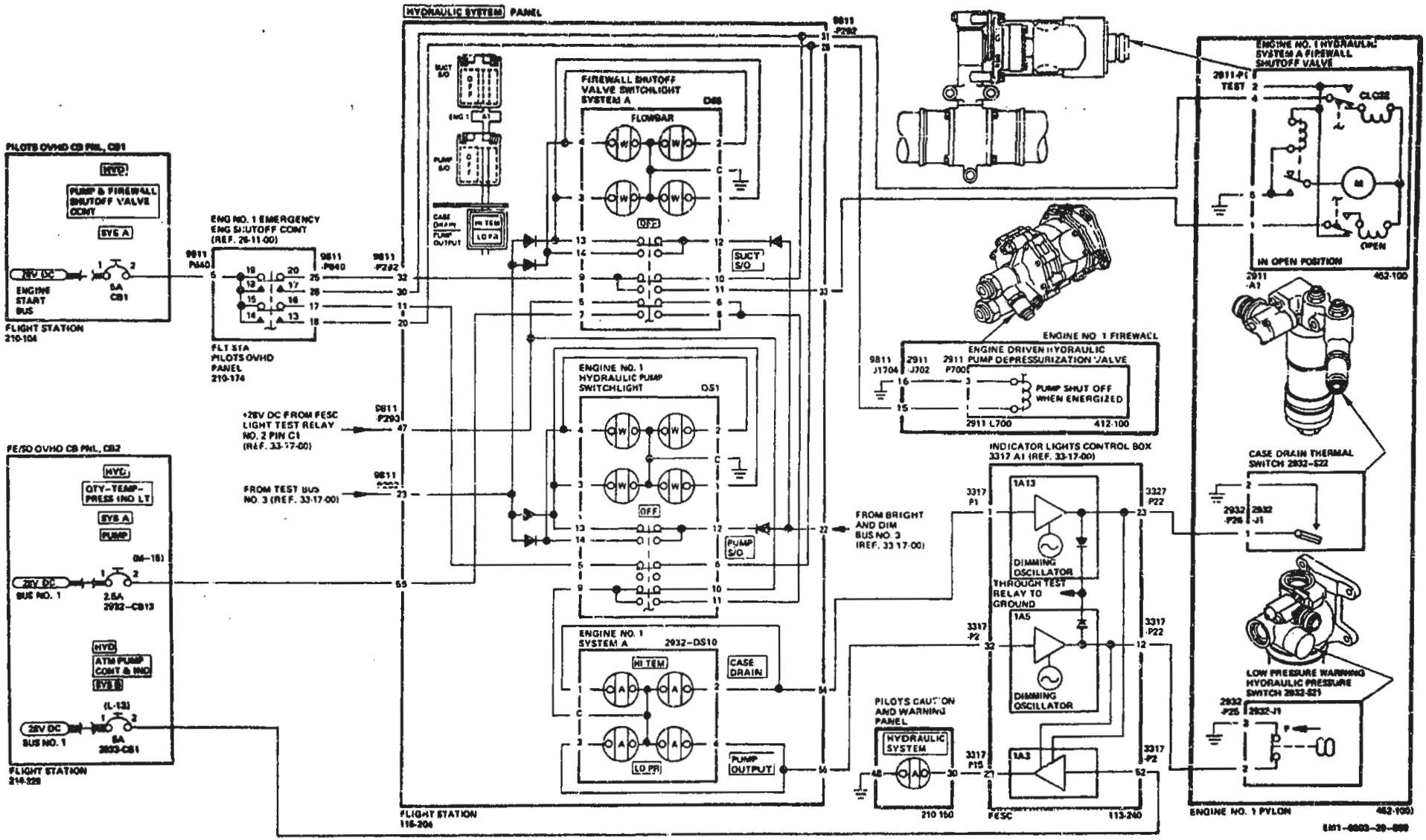
Rudder System A Hydraulic Fusing Fault Isolation
Figure 116


HYDRAULIC PRESSURE INDICATION ABNORMAL
PREREQUISITES
ELECTRICAL POWER (HM24-41-00)
HYDRAULIC POWER (HM29-11-00)
CB'S: 2M12, 2M13.
1 VERIFY FOLLOWING:
A. RSVR PRESSURE OK (70 PSI MIN).
B. FLUID QTY SAFE LEVEL.
C. RSVR/SYSTEM AIR BLEED OK.
IS FE/EO PANEL PRESS INDICATION HIGH, LOW, OR FLUCTUATING? 1
HIGH
3 CHECK PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.
IS PRESSURE HIGH?
YES
6 WITH NO FLOW DEMAND (ALL SERVOS OFF) AND AC PUMPS BEING USED, 2500 PSIG PRESSURE IS POSSIBLE. THIS CONDITION IS NOT DETRIMENTAL TO SYSTEM.
IF ENGINE DRIVEN PUMPS ARE PRESSURE SOURCE AND PROBLEM PERSISTS, REPLACE PUMP (HM29-11-07).
WITH HIGH FLOW DEMAND ON SYSTEM (IE, FLAP, SLAT, OR LANDING GEAR OPERATION) AND HYDRAULIC PRESSURE IS HIGH, CHECK CASE DRAIN FILTER FOR AFFECTED SYSTEM.
NO
7 REPLACE PRESS INDICATOR (HM29-31-09).
IF PROBLEM PERSISTS, REPLACE PRESSURE TRANSMITTER (HM29-31-09).
LOW
ERRATIC/ FLUCTUATING
4 CHECK ELECTRICAL PLUG CONNECTORS AT PRESSURE TRANSMITTER AND AT INDICATOR FOR LOOSE OR DIRTY CONTACTS.
ARE PLUGS OK?
NO
8 CLEAN OR REPLACE CONNECTORS AS REQUIRED.
YES
9 CHECK AIRCRAFT WIRING FOR LOOSE CONNECTORS OR BROKEN WIRES (HM29-31-01.02).
2 CHECK PRESSURE GAGE ON HYDRAULIC SERVICE PANEL, ZONE 147.
IS PRESSURE LOW?
YES
5 IS SYSTEM RELIEF VALVE BYPASSING (AUDIBLE OR HEAT BUILDUP)?
YES
10 REPLACE SYSTEM RELIEF VALVE (HM29-11-29).
NO
11 REPLACE PUMP (HM29-11-07).
NO
12 REPLACE PRESS INDICATOR (HM29-31-09).
IF PROBLEM PERSISTS, REPLACE PRESSURE TRANSMITTER (HM29-31-09).
NOTE
1 WITH NO FLOW DEMAND (ALL SERVOS OFF) NORMAL PRESSURE SHOULD BE 2500 - 3100 PSI.

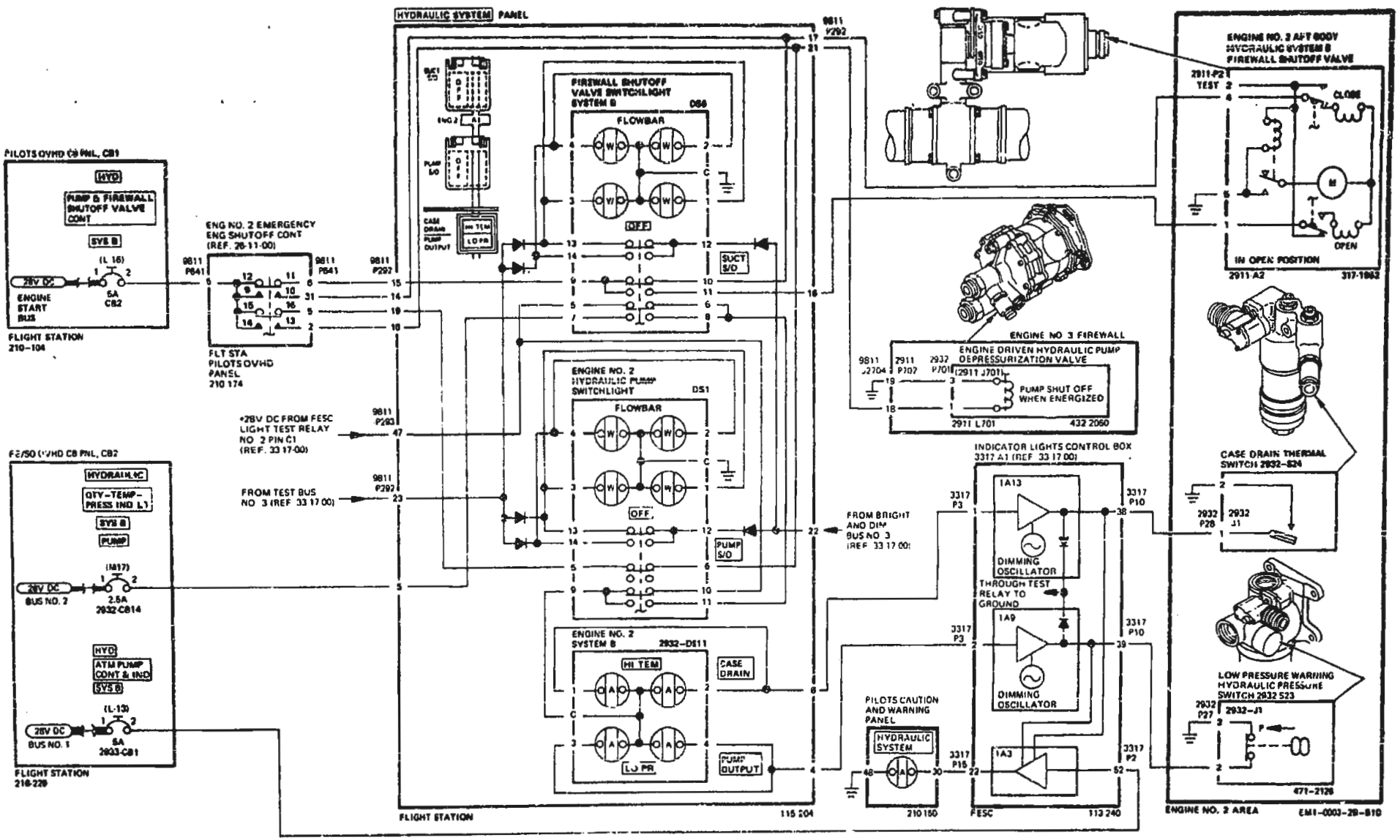
Hydraulic Pressure Indication Abnormal
Figure 117


ENGINE-DRIVEN PUMP CONTROL PROBLEMS
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: 1L15, 1L16, 1L17, 1L18, 2M15, 2M17, 2M18, 2M20
1 VERIFY THAT PUMP AND FIREWALL SHUTOFF VALVE CONT CIRCUIT BREAKER IS CLOSED AND THAT NO OTHER HYDRAULIC PUMP FOR THE APPLICABLE SYSTEM IS OPERATING.
WITH PUMP S/O SWITCH IN AND FLOWBAR ON OPERATE ENGINE-DRIVEN PUMP.
IS SYSTEM PRESSURE INDICATED?
NO
YES
2 POSITION PUMP S/O SWITCH TO OFF (SWITCH IN AND FLOWBAR OUT).
DOES SYSTEM PRESSURE GO TO ZERO PSI?
NO
YES
3 SYSTEM OPERATIONAL
4 IS FIREWALL SHUT OFF VALVE OPEN?
NO
YES
5 IS APPLICABLE SYSTEM RESERVOIR PRESSURE NORMAL (APPORX 70 PSI)?
YES
NO
6 CHECK PRESSURE INDICATION ON HYDRAULIC SERVICE PANEL, ZONE 147.
IS PRESSURE ZERO PSI?
YES
NO
7 SHUT DOWN ENGINE AND WITH PUMP S/O IN OFF POSITION CHECK FOR 28V DC AT PIN 1 OF THE PUMP SOLENOID DEPRESSURIZATION VALVE.
IS VOLTAGE OK?
YES
NO
8 OPEN FIREWALL SHUTOFF VALVE.
IF FIRE PULL HANDLE WAS IN, CHECK FOR 28V DC AT PIN 1 (SCHEM 1-4).
IF VOLTAGE OK, REPLACE FIREWALL SHUTOFF VALVE (MM28-11-32).
IF PROBLEM PERSISTS, CHECK FIRE PULL HANDLE SWITCH OPERATION AND AIRCRAFT WIRING FOR OPEN CIRCUIT (WM28-11-01, 02, 03, 04).
9 REPLACE HYDRAULIC PUMP (MM28-11-07).
10 CHECK RESERVOIR FOR INTERNAL LEAKAGE OR FOR PISTON BINDING.
IF DEFFECTIVE, REPLACE RESERVOIR (MM28-11-01).
11 REPLACE PRESS INDICATOR ON FE/SC PANEL (MM28-31-09).
12 REPLACE PUMP (MM28-11-07).
13 CHECK PUMP S/O SWITCH OPERATION AND AIRCRAFT WIRING FOR OPEN CIRCUIT (MW28-11-01, 02, 03, 04).
HYD
PUMP & FIREWALL SHUTOFF VALVE CONT
SYS D
WM24-54-06
28V DC
(L18)
5A CB4
ENGINE START BUS
210-194
ENGINE NO. 3 EMERGENCY SHUTOFF CONTROL
9811 -P642
19
20
25
18
17
26
5
15
16
17
14
13
18
ENGINE DRIVEN HYDRAULIC PUMP DEPRESSURIZATION VALVE
9811 -P7000
(2911 -J700)
1
3
PUMP SHUT OFF WHEN ENERGIZED
2911-L700
422-100
FIREWALL SHUTOFF VALVE
M
5
3
1
OPEN
IN OPEN POSITION
2911-A4
462-100
M1-6000-29-013

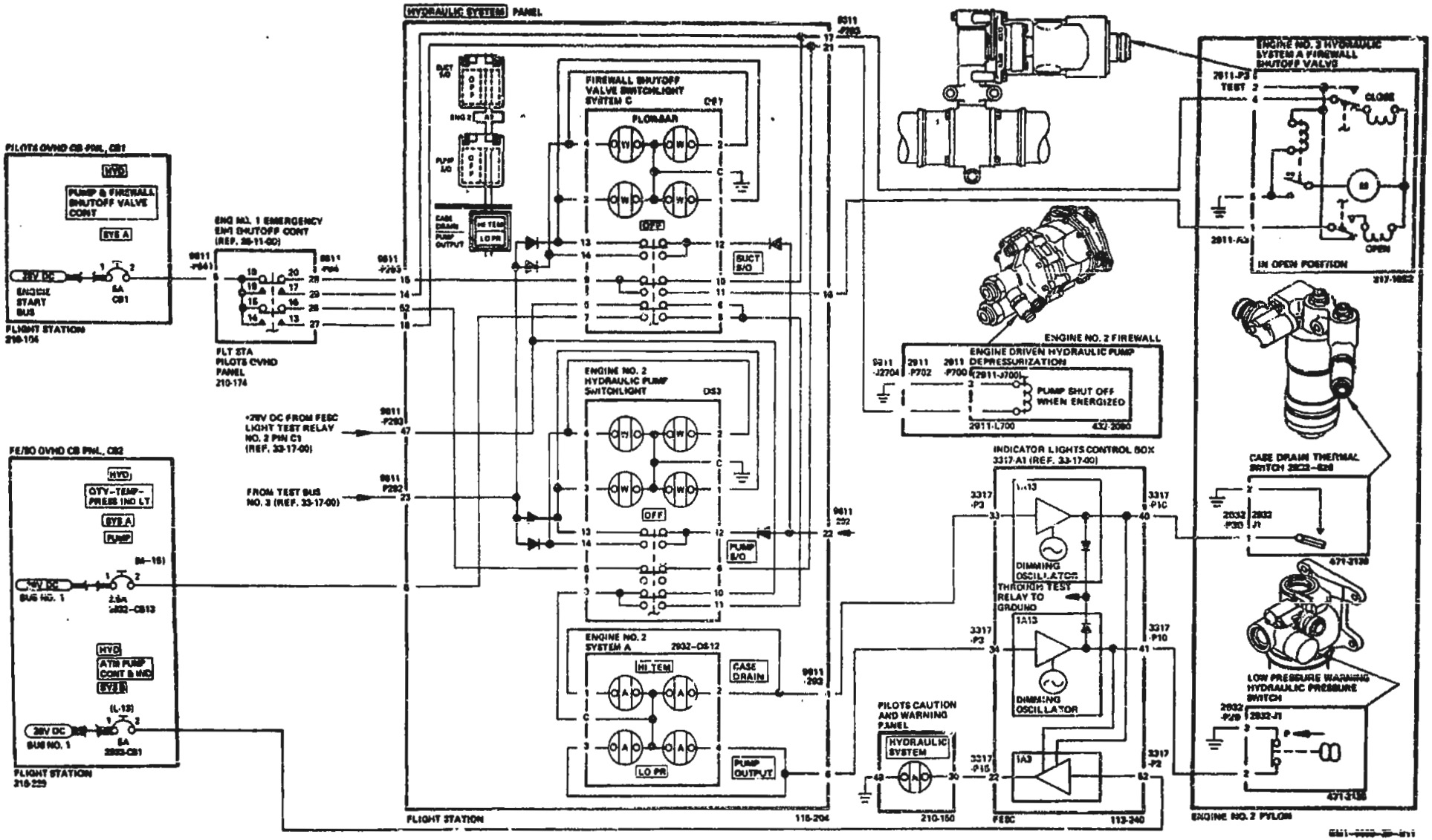
Engine-driven Pump Control Problems
Figure 118



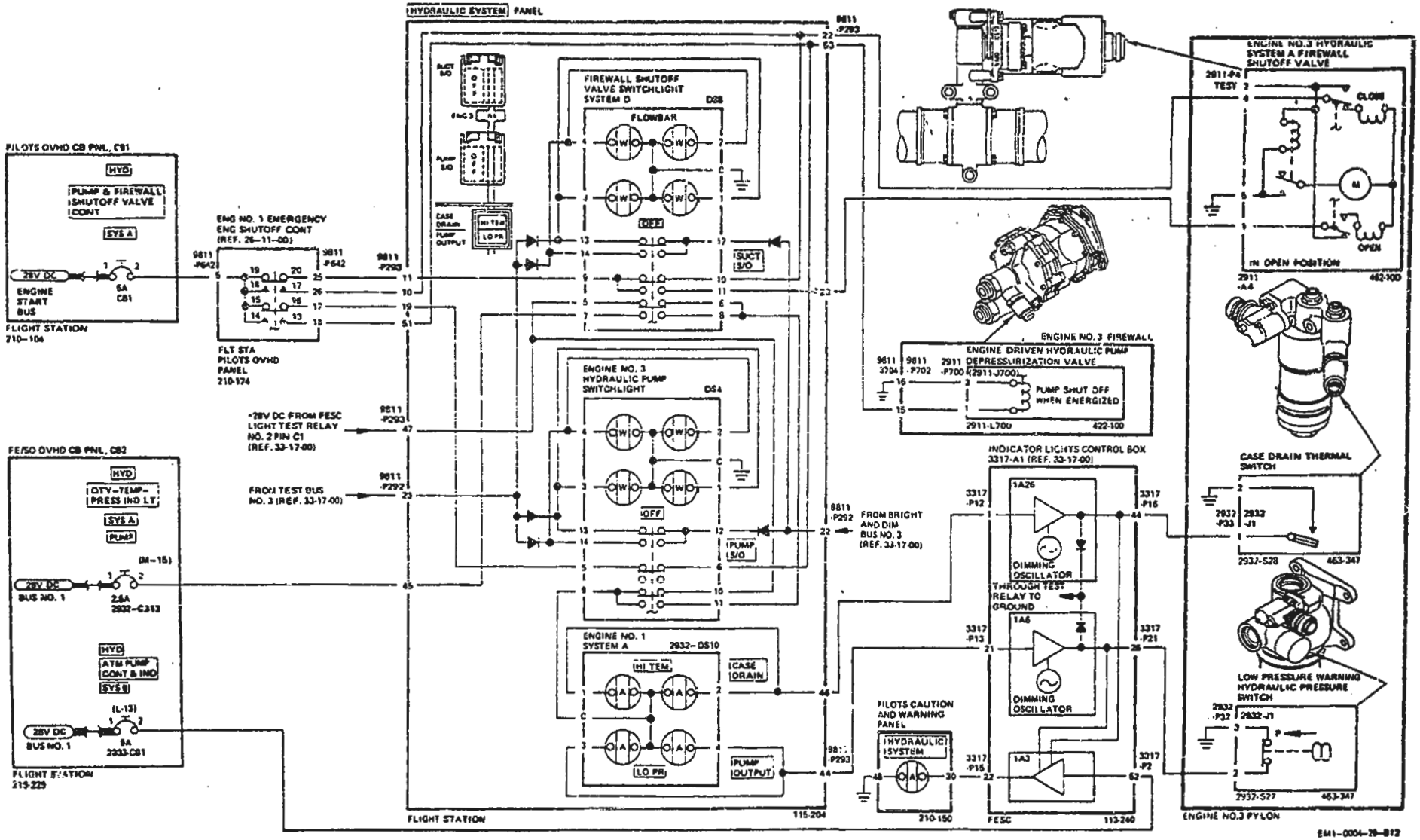
System A Engine-driven Pump Electrical Schematic
SCHEM 1



System B Engine-driven Pump Electrical Schematic
SCHEM 2



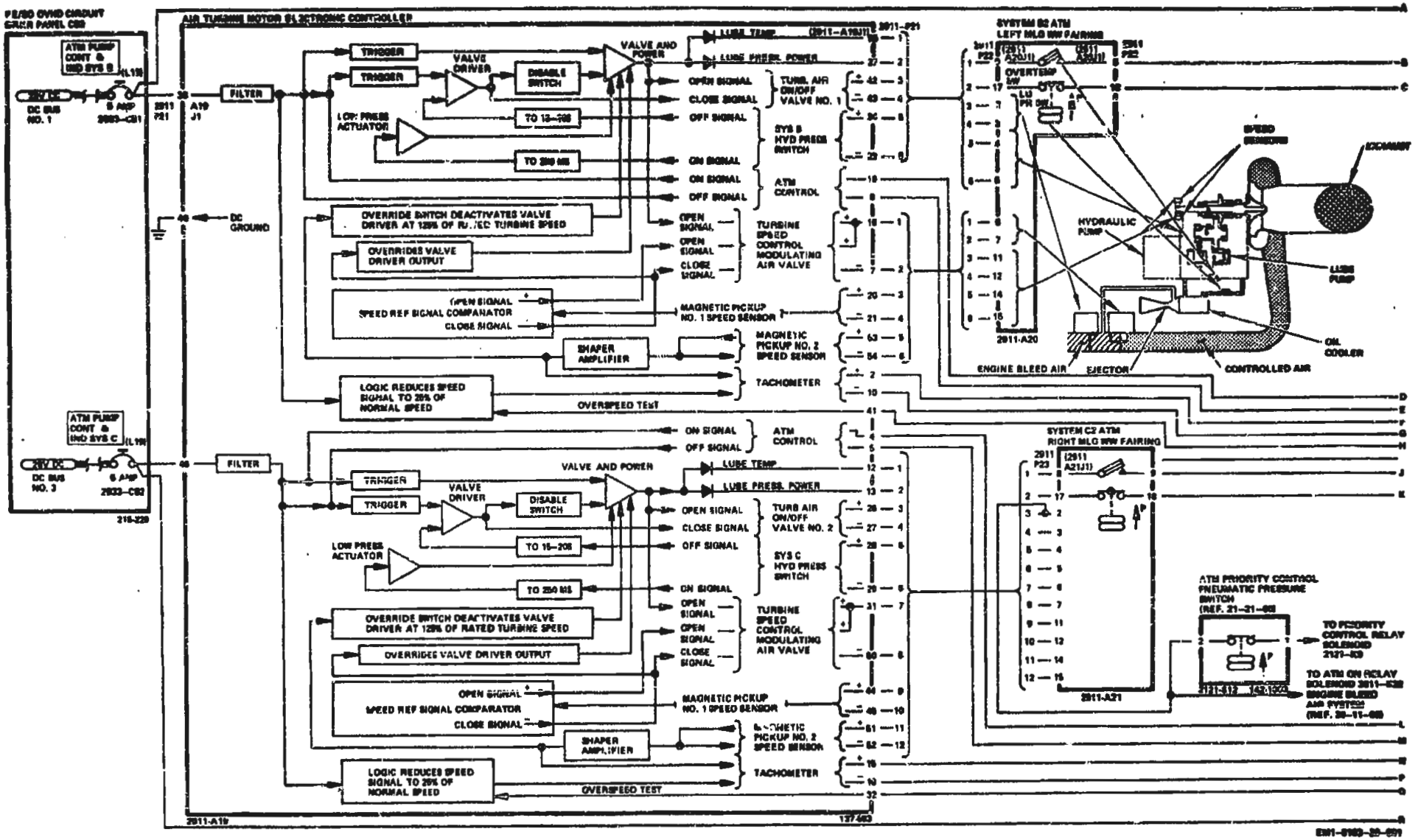
System C Engine-driven Pump Electrical Schematic
SCHEM 3



R System D Engine-driven Pump Electrical Schematic
R SCHEM 4

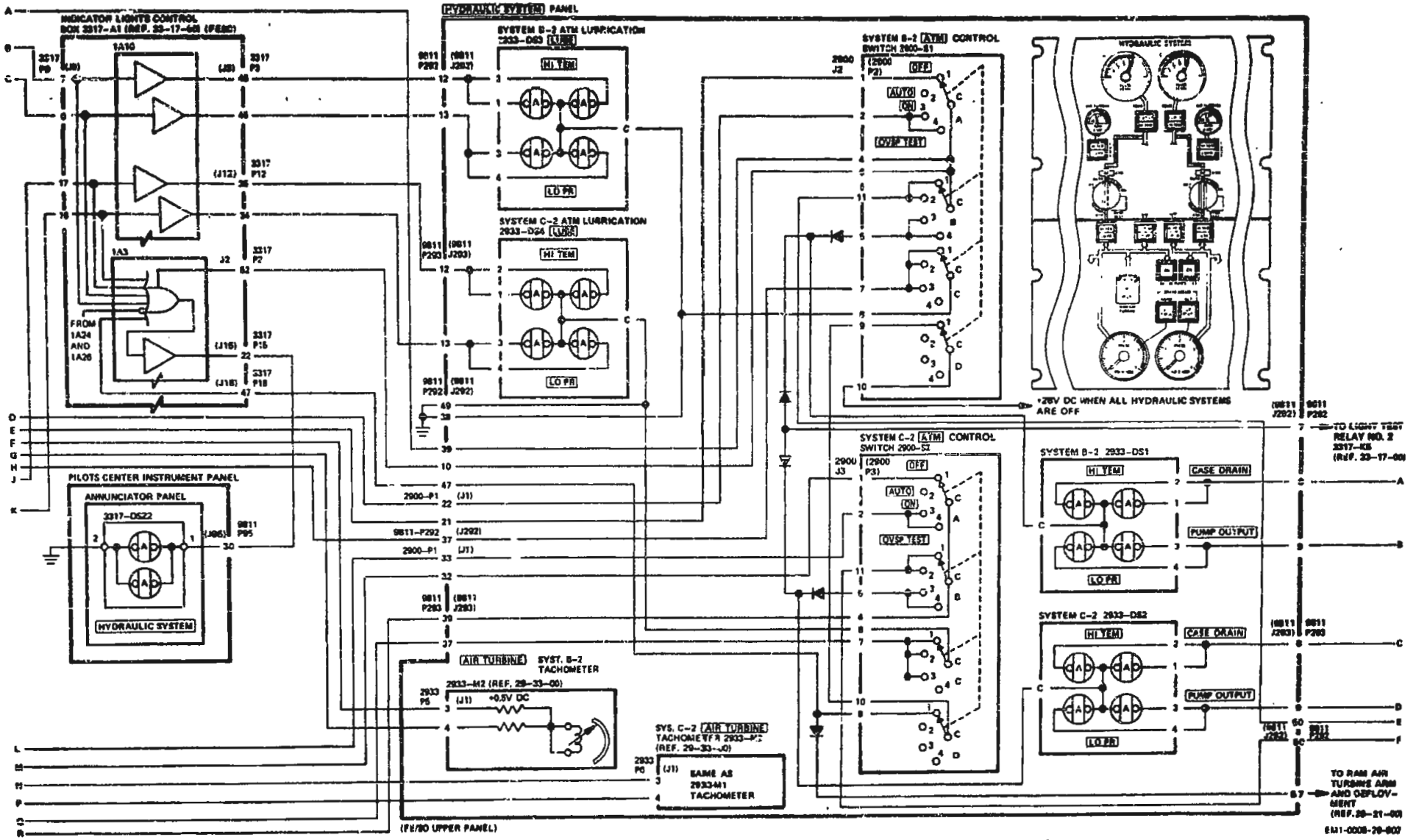
EFFECTIVITY: ALL

001B



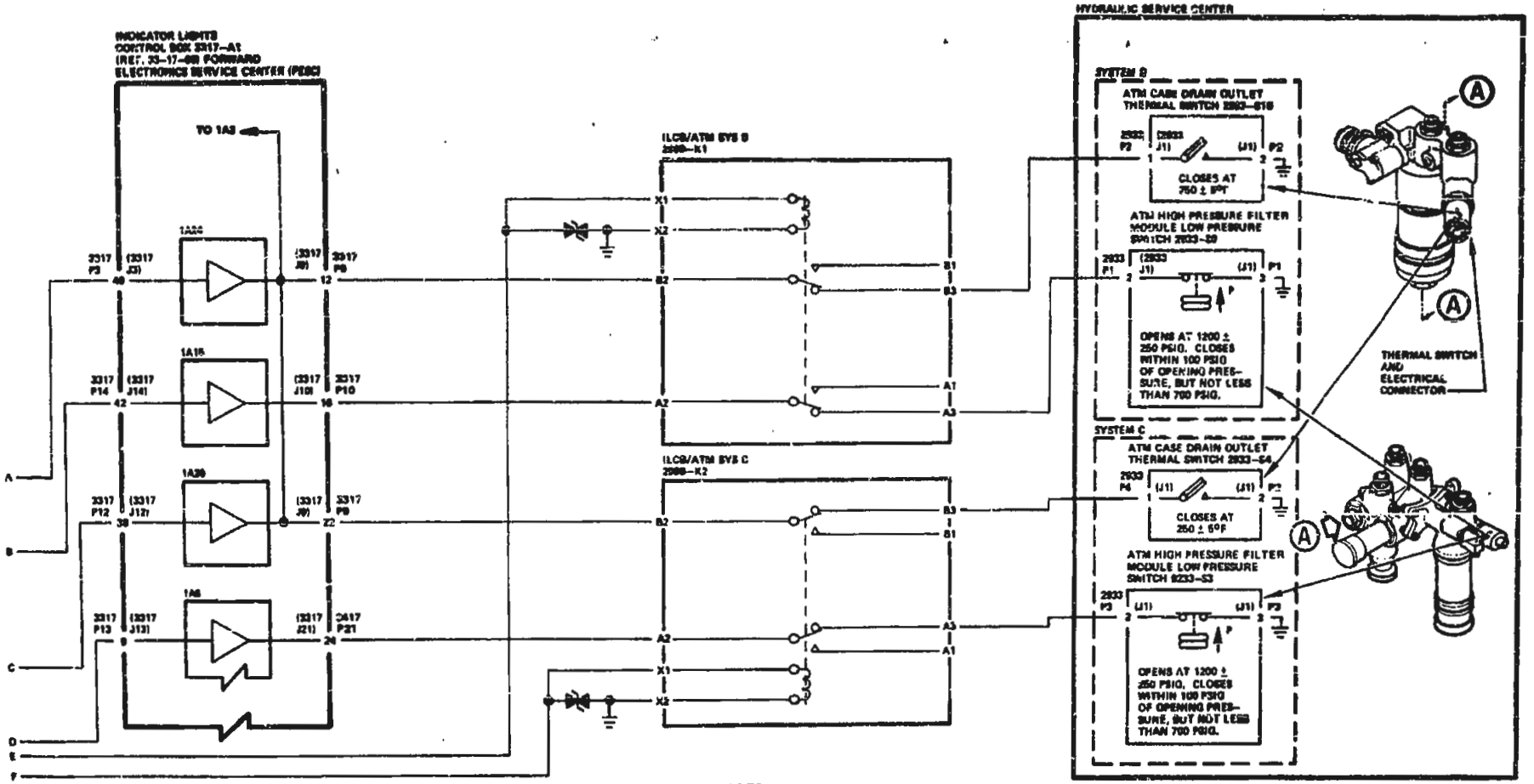
ATM Pumps Electrical Schematic
SCHEM 5 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



ATM Pumps Electrical Schematic
SCHEM 5 (Sheet 2)

R EFFECTIVITY: ALL
R
0018

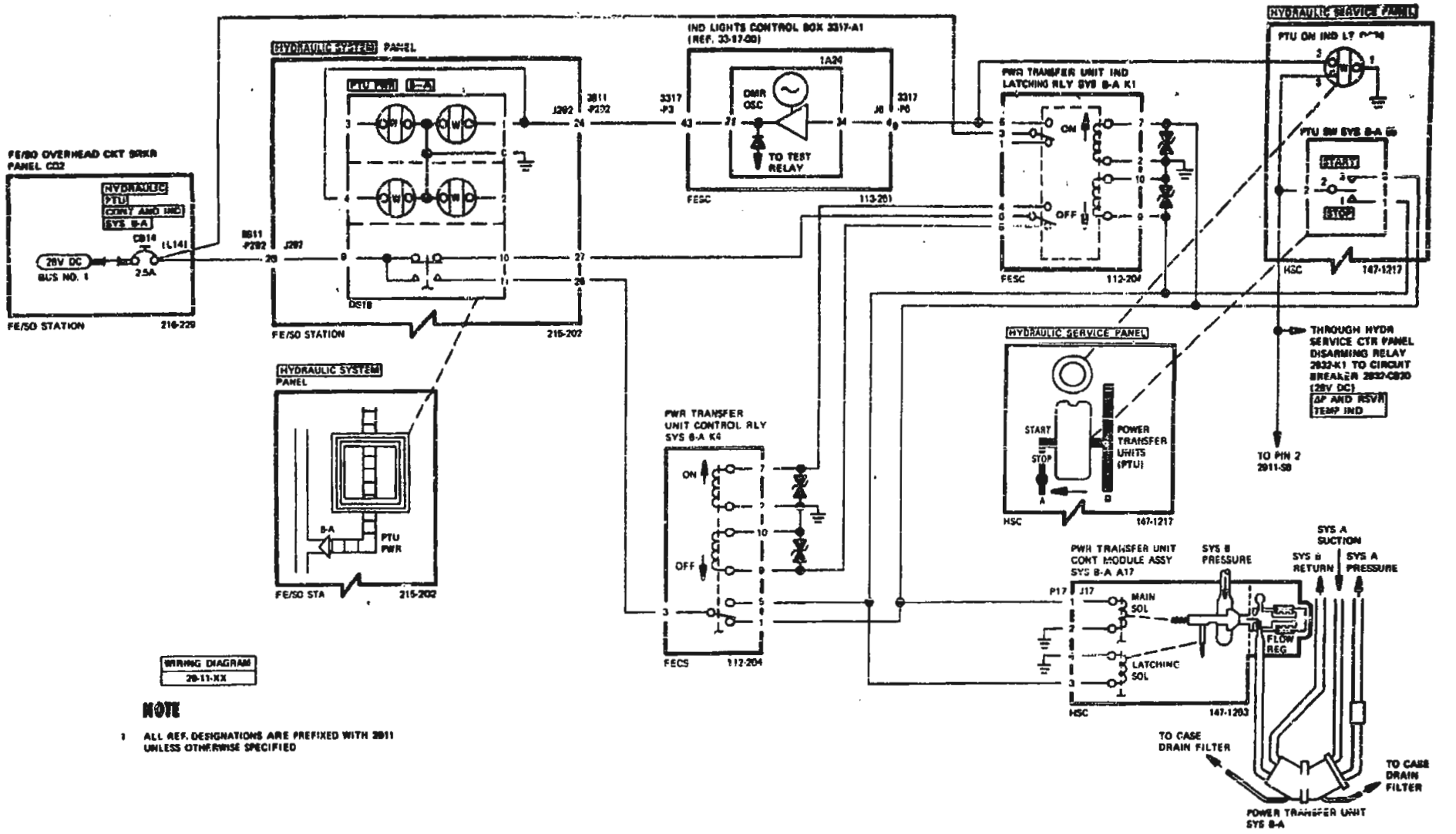


NOTE

1 ALL DESIGNATIONS ARE PREFIXED WITH 2911 UNLESS OTHERWISE NOTED

ATM Pumps Electrical Schematic
SCHEM 5 (Sheet 3)

R
R
0018 EFFECTIVITY: ALL



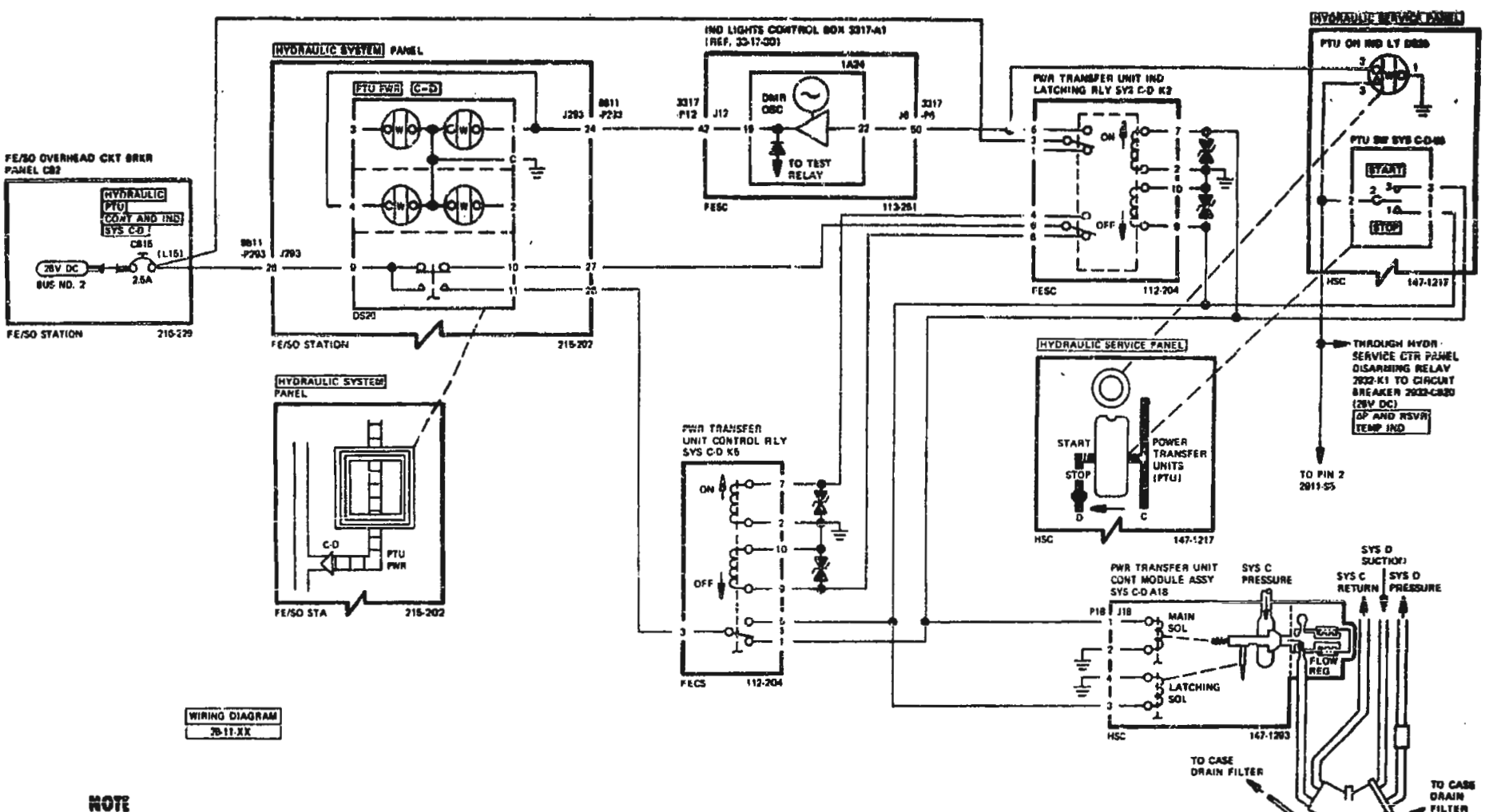
WIRING DIAGRAM
29-11-XX

NOTE

1 ALL REF. DESIGNATIONS ARE PREFIXED WITH 2911 UNLESS OTHERWISE SPECIFIED

PTU B-A Electrical Schematic
SCHEM 6

R EFFECTIVITY: ALL
R
001B



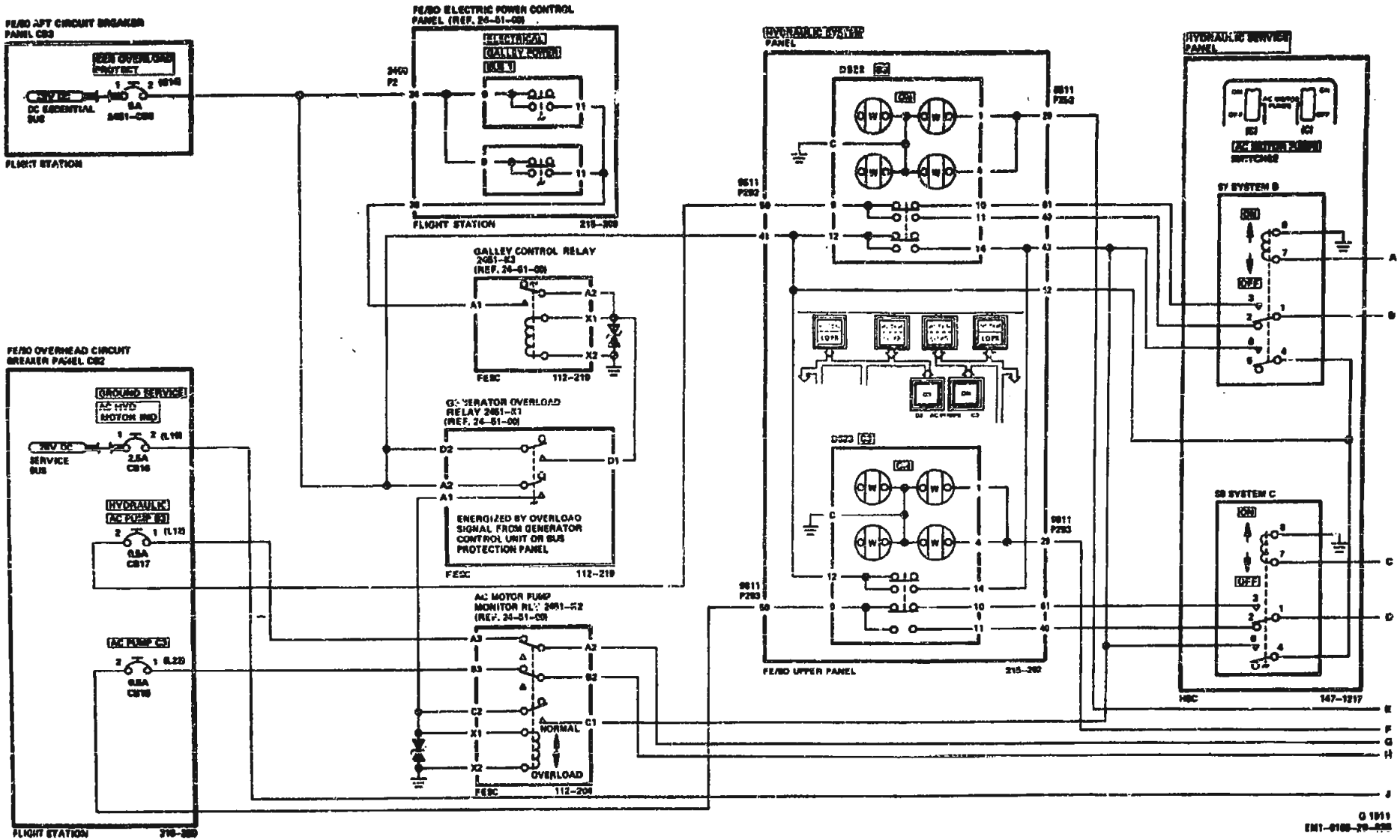
NOTE

1 ALL REF. DESIGNATIONS ARE PREFIXED WITH 2911 UNLESS OTHERWISE SPECIFIED

EM1-0102-29-010

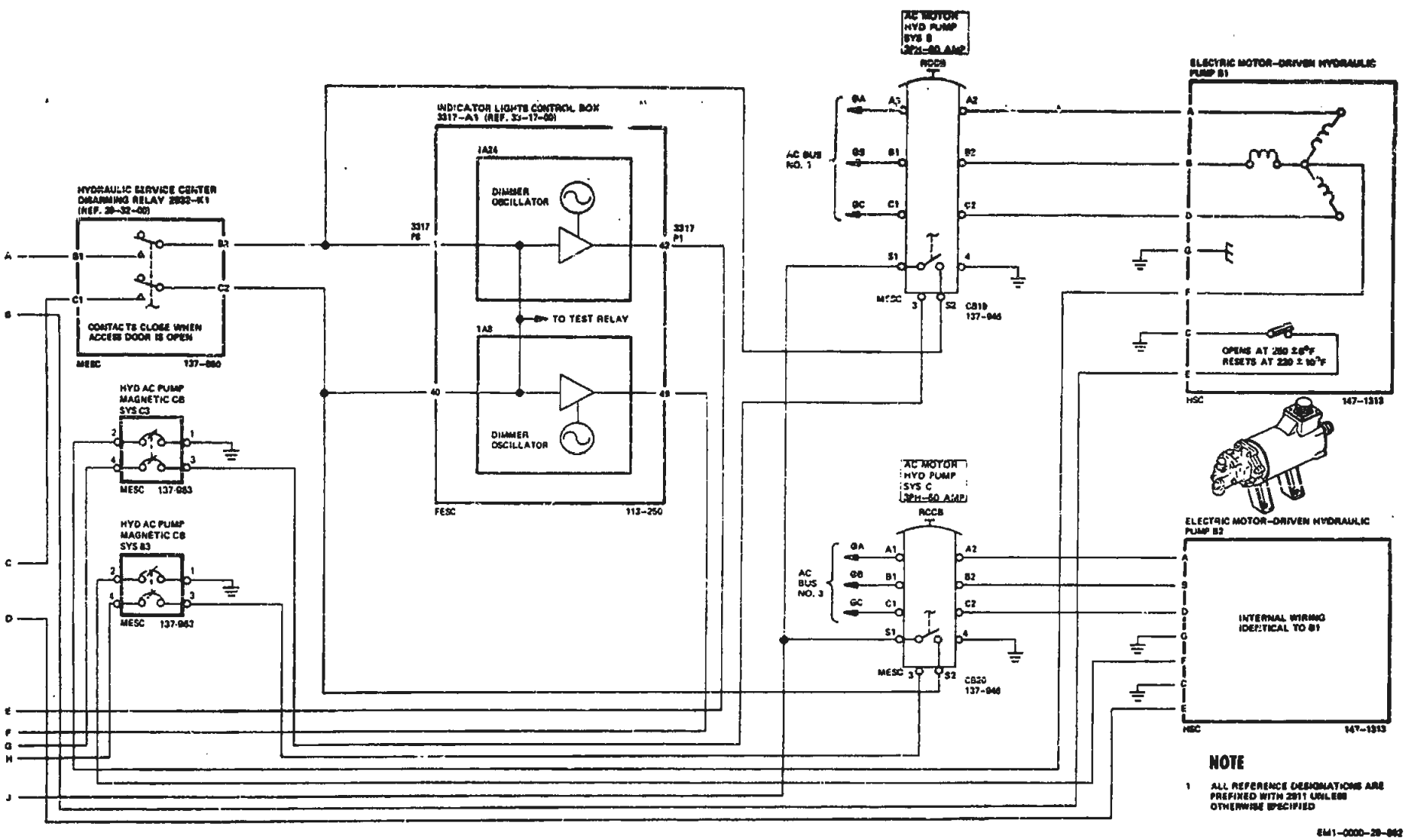
PTU C-D Electrical Schematic
SCHEM 7

R EFFECTIVITY: ALL
R
001B

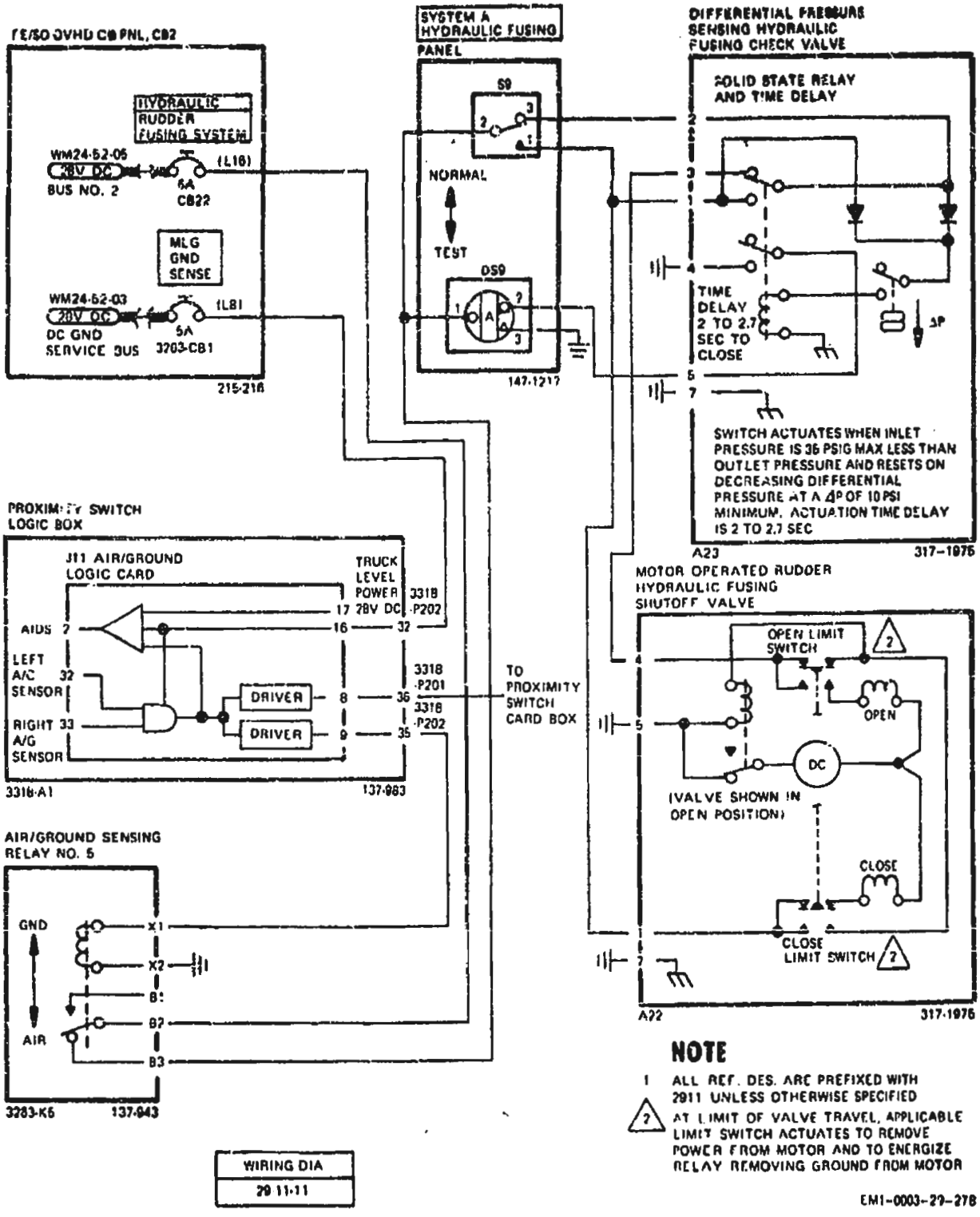


AC Pumps Electrical Schematic
SCHEM 8 (Sheet 1)

R EFFECTIVITY: ALL
R
001S



AC Pumps Electrical Schematic
SCHEM 8 (Sheet 2)



NOTE

1 ALL REF. DES. ARE PREFIXED WITH 2911 UNLESS OTHERWISE SPECIFIED

2 AT LIMIT OF VALVE TRAVEL, APPLICABLE LIMIT SWITCH ACTUATES TO REMOVE POWER FROM MOTOR AND TO ENERGIZE RELAY REMOVING GROUND FROM MOTOR

EMI-0003-29-278

Rudder System A Hydraulic Fusing Electrical Schematic
SCHEM 9

HYDRAULIC POWER SYSTEM - MAINTENANCE PRACTICES

1. Maintenance Practices

A. General

WARNING: PRIOR TO MAINTENANCE PROCEDURES IN OR NEAR HYDRAULIC SERVICE CENTER VERIFY THAT THE RAM AIR TURBINE (RAT) GROUND SAFETY LOCK IS INSTALLED OVER THE RAT DOORS.

WARNING: BEFORE DISCONNECTING ANY HYDRAULIC LINE OR COMPONENT, VERIFY ZERO RESERVOIR PRESSURE ON HYDRAULIC SERVICE PANEL, ZONE 147.

Hydraulic reservoir fluid levels should be checked before pressurization of any hydraulic system. Fluid levels can be checked on the HYDRAULIC SERVICE PANEL, zone 147 or on the direct reading gage on each reservoir.

R The control column and trim wheel lock (G/ITEL 27-41-01, or
R equivalent) is required to lock the pitch control system to
R ensure ground safety during afterbody maintenance by
R preventing inadvertent movement of the stabilizer (Ref. Fig.
R 204). The pitch trim wheel must be locked at zero degree
R trim, the control must be locked in the plus one degree
R stabilizer leading edge up position, and the pitch coupler
R handle must be locked in the coupled position.

Hydraulic reservoir pressurization (85 psi) is accomplished by the bootstrap principle. Reservoir pressurization is maintained by a accumulator after all pumps are shut off. System pressure decays rapidly until at approximately 2000 psi a priority valve closes and isolates the accumulator and the small end of the reservoir. Supply and return system pressure will stabilize at approximately 50 psi, and will drop slowly. Pressure in all parts of the hydraulic system may be maintained over several days.

B. Depressurization Procedures

Depressurization is divided into two functions. Depressurization of a reservoir is done during reservoir bleeding procedures for the purpose of measuring air trapped in a hydraulic system and depressurization of an associated reservoir accumulator is done prior to opening a hydraulic line pressurized by the accumulator.

(1) Depressurizing A Reservoir

Rotate depressurization valve handle clockwise through ACCUM DUMP position to RSVR DEPRESS position. Do not stop at ACCUM DUMP position. Hold handle in RSVR DEPRESS position until applicable SYS RESERVOIR PRESSURE gage on HYDRAULIC SERVICE PANEL, zone 147, indicates 0 psi. Release handle and verify that handle has returned to fully counterclockwise NORM position.

(2) Depressurizing An Associated Accumulator

Rotate depressurization valve handle clockwise to ACCUM DUMP position and hold until applicable SYS RESERVOIR PRESSURE gage on HYDRAULIC SERVICE PANEL, zone 147, indicates 0 psi. Release handle and verify that handle has returned to fully counterclockwise NORM position.

C. Pressurization Methods

Any of the following methods can be used to pressurize hydraulic power systems A, B, C, or D.

(1) AC motor-driven pump hydraulic system pressurization (Ref. Para. 4A).

(2) Air turbine motor-driven pump hydraulic system pressurization using APU load compressor air, or high-pressure ground air (Ref. Para. 4B and 4C).

(3) Hydraulic ground test cart hydraulic system pressurization (Ref. Para. 4D).

(4) Engine-driven pump hydraulic system pressurization (Ref. Para. 4E).

Each AC motor-driven pump provides 10.5 gpm flow at 1850 psi, and 6.6 gpm at 2900 psi. Each air turbine motor-driven (ATM) and engine-driven pump provides 37.5 gpm flow at 3050 psi. Ground test carts provide flow rates as determined by design capacity. Some sample component/system flow requirements for normal operation are as follows: landing gear system - approx 60 gpm, flaps - 12 gpm, slats - 8 gpm, flight control surface servos - up to 24 GPM (depending on rate of travel). The AC motor-driven pumps will provide brake accumulator charging, reserovir pressurizations, component/system leakage checks and minimal operational tests within the low-flow capacity of the pumps. To obtain normal system operation, use the pressurization method with the required flow capability.

D. Hydraulic System Bleeding

Air in the hydraulic system can cause spongy flight control operation and can also be detrimental to hydraulic pump service life. The bleeding practices and procedures provided in Para. 5 will assist in keeping the hydraulic system free of air entrapment during normal operation and during maintenance operations when the hydraulic system must be opened.

E. Hydraulic System Flushing

When hydraulic fluid sampling and analysis indicates that a hydraulic system has been contaminated, the system must be flushed and associated filter replaced (Ref. Para. 6).

C Hydraulic System Failure or loss of fluid supply to
C hydraulic pumps may require replacement of hydraulic pumps
C (Ref. Para. 8).

The pump pressure and case drain lines from the pump to the
C filters must be flushed when a failed pump is replaced (Ref.
C Para. 9). EDP ground operation is restricted under certain
C conditions (Ref. Para. 10). Misalignment in the ground
C service disconnect area may require adjustment (Ref. Para.
C 11).

2. Equipment and Materials

Pneumatic High-pressure Service Cart

Hydraulic Ground Test Cart, B784C, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Hydraulic Hose Support Assembly, BC64-101, or
Hydraulic Used Fluid Containers (55-gallon drums)

Flexible hose with -20 Dynatube male fitting (Approximately 25 feet long)

Plumbing Adapters

Jumper Hoses

Protective Caps, -16 and -20 Dynatube

3. Referenced Procedures

6-40-00 Exterior Access Doors and Removable Panels

7-11-00 Wing and Fuselage Jacking - Maintenance Practices

12-13-00	Hydraulic System Replenishing
12-13-01	Hydraulic Fluid Replenishing - Servicing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-00-00	Hydraulic Power - Inspection and Check
29-11-07	Engine-driven Hydraulic Pump - Removal and Installation
29-11-08	Electric Motor-driven Hydraulic Pump - Removal and Installation
29-11-14	High-pressure Filter Housing Assembly - Removal and Installation
29-11-19	High-pressure Filter Element - Removal and Installation
29-11-22	Return Filter Element - Removal and Installation
29-11-23	Case Drain Filter Module Assembly - Removal and Installation
29-11-28	Case Drain Filter Element - Removal and Installation
29-11-71	Air Turbine Motor-driven Hydraulic Pump - Removal and Installation
36-13-00	High-pressure Ground Air System - Maintenance Practices
36-14-00	Pneumatic System Distribution - Maintenance Practices
49-00-01	Auxiliary Power Unit (APU) - Adjustment and Test
71-00-00	Power Plant - Adjustment and Test

4. Hydraulic System Pressurization

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

C LANDING GEAR DOWNLOCK SAFETY PINSINSTALLED IF REQUIRED
C PER GP&P 7-4-0 AND DOOR SAFETY DEVICES ARE INSTALLED
C IF DOORS ARE OPEN AND WORK IS TO BE PERFORMED IN WHEEL
C WELL .

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

NOTE: The PTU operates on differential pressure between the motor and pump, and is an "On Demand" operation. The PTU may not operate smoothly until approximately 3.5 gal/min flow demand is present. With flow demand less than 3.5 gpm system pressure fluctuations in range of 2200 to 3500 psi may exist and is normal.

A. AC Motor-driven Pumps

AC motor-driven pumps pressurize hydraulic systems B and C and, by use of power transfer units (PTU), systems A and D. System A and D pressure will be approximately 300 psi below normal due to mechanical loss through the PTU.

Table 201 lists the minimum AC pump pressure acceptable for various combinations of PTU and servo valve activation. Servo valves are deactivated when switchlights on pilots overhead PFCS panel are released (out). Critical systems
C are the rudder, stabilizer, aileron, and spoiler. The only
C requirement is airplane on ground - all servo valves in
C Systems "A", "B", "C", and "D" on - PTU's on. Minimum
C pressure is: "A" - 900 PSI, "B" - 1300 PSI, "C" - 1700 PSI,
C and "D" - 1400 PSI.

AC Pump System Minimum Pressure
Table 201

	SYSTEM	A AND D SERVO VALVES	B AND C SERVO VALVES	PTU	MINIMUM PRESSURE
	Aircraft on ground using AC Motor - Pumps				
C	"B"	OFF	OFF	OFF	2850 psig
C	"C"	OFF	OFF	OFF	2850 psig
	"B"	OFF	ON	OFF	2500 psig
	"C"	OFF	ON	OFF	2500 psig
	"A"	OFF	ON	ON	2100 psig
	"B"	OFF	ON	ON	2500 psig
	"C"	OFF	ON	ON	2500 psig
	"D"	OFF	ON	ON	2100 psig
	"A"	ON	OFF	ON	1750 psig
	"B"	ON	OFF	ON	2000 psig
	"C"	ON	OFF	ON	2300 psig
	"D"	ON	OFF	ON	2050 psig
	"A"	ON	ON	ON	900 psig
	"B"	ON	ON	ON	1300 psig
	"C"	ON	ON	ON	1700 psig
	"D"	ON	ON	ON	1400 psig

AC motor-driven pumps can be operated from the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, or from the HYDRAULIC SERVICE PANEL, zone 147.

WARNING: UNEXPECTED AC PUMP RESTART CAN OCCUR FOLLOWING A THERMAL SWITCH SHUTDOWN. THE AC PUMP CONTROL SWITCH USED TO INITIATE PUMP OPERATION SHOULD BE PLACED TO OFF DURING THE COOL DOWN PERIOD.

NOTE: If all flight control servo valves are in the off condition (no hydraulic flow demand) the pressure

indicated on the HYDRAULIC SYSTEM panel for systems B and C can exceed the green band (3200 psig max). This is not detrimental to the aircraft system.

Under conditions of high ambient temperatures and extended pump operation, the hydraulic reservoir temperatures must be monitored to prevent pump overheating causing the thermal switch to open. If the thermal switch opens, a 90-second cooling period is required before restarting the pump. Reservoir temperature can be monitored by the temperature gage on the HYDRAULIC SERVICE PANEL, or by the RSVR HI TEM light on the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel. The primary flight controls should be operative and exercised periodically to maintain lower reservoir temperatures.

At moderate ambient temperature, both pumps can be operated together without time limitation, provided the reservoir temperature remains in the normal range.

When ambient temperature is 110 degrees F or above, it is recommended to use system B, then system C, in alternating cycles. Table 202 provides operating time cycles for various temperatures.

AC Pump Ambient Temp/Time Limitations
Table 202

AMBIENT TEMP. (DEGREE F)	OPERATING TIME CYCLES (MINUTES)	
	ON	OFF
86	No Limit	None
90	60	60
100	30	30
110	20	20
120	15	15

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed (Ref. Fig. 201):

QTY - TEMP - PRESS IND LT

SYS A - RSVR (M14)

SYS B - RSVR (M16)

SYS C - RSVR (M18)

SYS D - RSVR (M20)

AC PUMP B3 (L12)

PTU - CONT & IND

SYS B-A (L14)

SYS C-D (L15)

AC PUMP C3 (L22)

(2) Turn on electrical power (Ref. 24-41-00).

(3) Open hydraulic service center access doors 147AB and 147BB to operate HYDRAULIC SERVICE PANEL controls, or gain access to Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215 (Ref. 6-40-00).

(4) To pressurize the applicable hydraulic system from the Flight Engineer/Second Officers panel proceed as follows:

(a) System A: depress B3 AC PUMP and B-A PTU switchlights to ON.

(b) System B: depress B3 AC PUMP switchlight to ON.

(c) System C: depress C3 AC PUMP switchlight to ON.

(d) System D: depress C3 AC PUMP C-D PTU switchlights to ON.

(5) To pressurize the applicable hydraulic system from the hydraulic service center proceed as follows:

(a) System A: place B SYS MOTOR PUMP toggle switch to ON, and B to A PTU momentary switch to START.

(b) System B: place B SYS AC MOTOR PUMP toggle switch to ON.

(c) System C: place C SYS AC MOTOR PUMP toggle switch to ON.

(d) System D: place C SYS AC MOTOR PUMP toggle switch to ON, and C to D PTU momentary toggle switch to START.

NOTE: During extended AC MOTOR PUMP operation, the fluid temperature should be monitored. On the HYDRAULIC SERVICE PANEL, rotate the RESERVOIR SELECTOR switch to the applicable system(s) periodically, and observe RESERVOIR TEMPERATURE indication.

NOTE: The PTU operates on differential pressure between the motor and pump, and is an "On Demand" operation. The PTU may not operate smoothly until approximately 3.5 gal/min flow demand is present. With flow demand less than 3.5 gpm system pressure fluctuations in range of 2200 to 3500 psi may exist and is normal.

(6) To shut off system pressure, release applicable Flight Engineer/Second Officers HYDRAULIC SYSTEM panel switches (light out) or place HYDRAULIC SERVICE PANEL switches to OFF/STOP and rotate RESERVOIR SELECTOR switch to OFF.

(7) Turn off electrical power (Ref. 24-41-00).

(8) Close and lock hydraulic service center access doors (Ref. 6-40-00).

B. ATM - driven Pumps (Using APU)

The ATM-driven pumps B2 and C2 provide hydraulic pressure for systems B and C. Operating procedures for each are identical. All controls are located on the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that the following circuit breakers are closed (Ref. Fig. 201):

ATM PUMP - CONT & IND - SYS B (L13)

ATM PUMP - CONT & IND - SYS C (L19)

PTU - CONT & IND

Sys B-A (L14)

SYS C-D (L15)

(2) Turn on electrical power (Ref. 24-41-00).

(3) Start APU to provide load compressor air (Ref. 49-00-01).

(4) Position pneumatic distribution manifold controls to direct air to applicable air turbine motor (ATM) (Ref. 36-14-00).

(5) To pressurize system B or C, place applicable ATM rotary switch in ON position and verify the following:

(a) ATM attains normal speed (green band on AIR TURBINE tachometer).

(b) Hydraulic system pressure (no control flow) stabilizes between 2850 and 3150 psi or applicable system pressure indicator.

C

(6) To pressurize system A, operate B2 ATM and depress B-A PTU momentary switchlight (flowbar light on).

(7) To pressurize system D, operate C2 ATM and depress C-D PTU momentary switchlight (flowbar light on).

NOTE: Systems A and D pressure will be approximately 300 psi below normal system pressure due to mechanical loss through PTU operation. The PTU operates on differential pressure between the motor and pump, and is an "On Demand" operation. The PTU may not operate smoothly until approximately 3.5 gal/min flow demand is present. With flow demand less than 3.5 gpm system pressure fluctuations in range of 2200 to 3500 psi may exist and is normal.

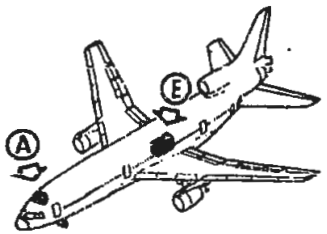
(8) When hydraulic pressure requirements have been completed, depress applicable PTU switchlight (flowbar light out) and place ATM rotary switch in OFF position.

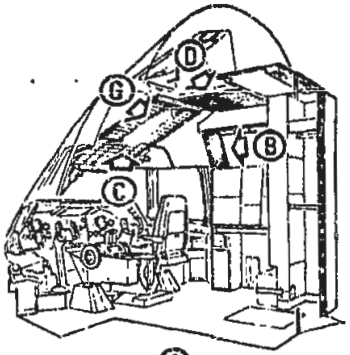
(9) Reposition pneumatic controls as required (Ref. 36-14-00).

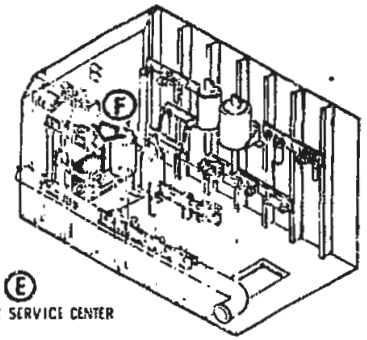
(10) Shut down APU (Ref. 49-00-01).

C. ATM - Driven Pumps (Using High-pressure Ground Air)

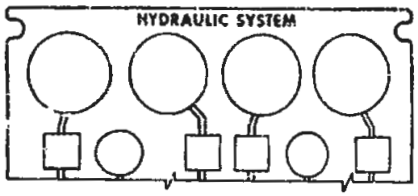
To operate the two ATM at the same time, the high-pressure ground air source must provide a minimum capacity of 300 pounds per minute at 65 psia and 500 degrees F, or 340 pounds per minute at 35 psia and 350 degrees F. The ATM-driven hydraulic pumps B2 and C2 provide pressure for

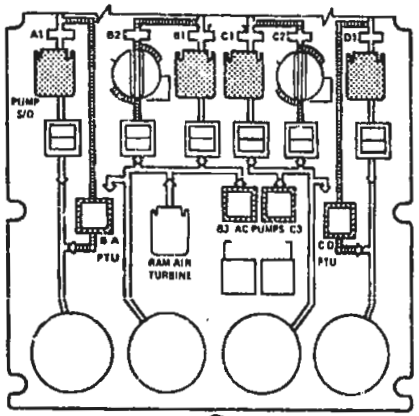






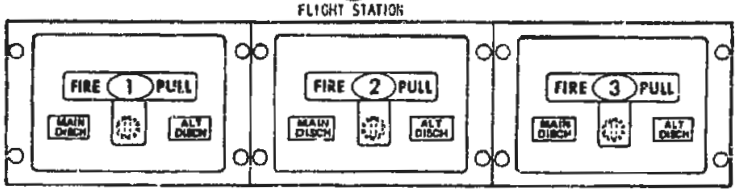
E HYDRAULIC SERVICE CENTER



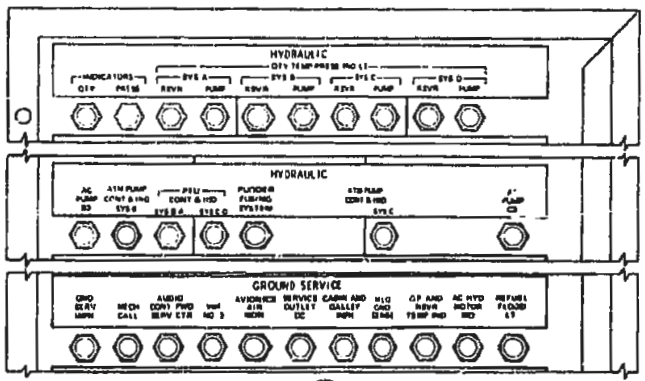


B HYDRAULIC SYSTEM CONTROL PANEL

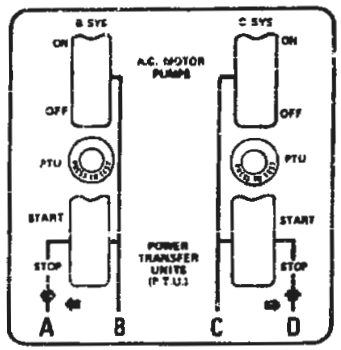
A FLIGHT STATION



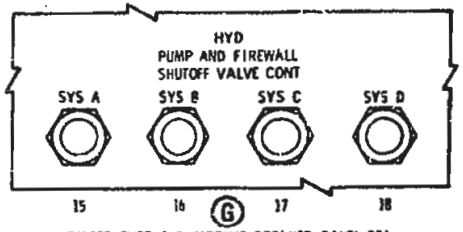
C FIRE PULL HANDLES



D F/SO OVHD CKT BRKR PNL CB2



F HYD SERVICE PANEL PRESSURIZATION CONTROLS



G PILOTS OVERHEAD CIRCUIT BREAKER PANEL CB1

C 904
M1-0101-29-128

Hydraulic System Pressurization Control Components Location
Figure 201

systems B and C. Operating procedures for both ATM are the same. All controls are located on the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that the following circuit breakers are closed (Ref. Fig. 201):

ATM PUMP - CONT & IND - SYS B (L13)

ATM PUMP - CONT & IND - SYS C (L19)

PTU - CONT & IND

SYS B-A (L14)

SYS C-D (L15)

(2) Turn on electrical power (Ref. 24-41-00).

(3) On bottom center of fuselage at the wing leading edge, connect the high-pressure ground air source to the pneumatic system ground air connections (Ref. 36-13-00).

(4) Position pneumatic distribution manifold controls to direct air to applicable ATM (Ref. 36-14-00).

(5) To pressurize system B or C, place applicable ATM rotary switch in ON position and verify the following:

(a) ATM attains normal speed (green band on AIR TURBINE tachometer).

NOTE: To obtain normal ATM speed, pneumatic manifold pressure must be 12.5 psi minimum.

(b) Hydraulic system pressure (no control flow) stabilizes between 2850 and 3150 psi on applicable system pressure indicator. C

(6) To pressurize system A, operate B2 ATM and depress B-A PTU momentary switchlight (flowbar light on).

(7) To pressurize system D, operate C2 ATM and depress C-D PTU momentary switchlight (flowbar light on).

NOTE: Systems A and D pressure will be approximately 300 psi below normal system pressure due to mechanical loss through PTU operation. The PTU operates on differential pressure between the motor and pump, and is an "On Demand" operation.

The PTU may not operate smoothly until approximately 3.5 gal/min flow demand is present. With flow demand less than 3.5 gpm system pressure fluctuations in range of 2200 to 3500 psi may exist and is normal.

(8) When hydraulic pressure requirements have been completed, depress applicable PTU switchlight (flowbar light out) and place ATM rotary switch in OFF position.

(9) Reposition pneumatic controls as required (Ref. 36-14-00).

(10) Shut off high-pressure service cart and remove hoses from ground air connections (Ref. 36-13-00).

(11) Turn off electrical power (24-41-00).

D. Ground Test Cart

(1) Open hydraulic service center access doors 147AB and 147BB (Ref. 6-40-00).

(2) Remove cap assemblies, and connect hydraulic ground test cart pressure and return hoses to applicable system pressure and return quick disconnects, using the aft access door for hose entry (Ref. Fig. 202).

(3) Install hose support assembly on aft access door sill and attach hoses to prevent excessive loads on quick disconnect fittings.

(4) Turn on electrical power (Ref. 24-41-00).

(5) Operate hydraulic ground test cart to pressurize system to 3050 (±50) psi. Maintain pressure until test requirements have been completed.

NOTE: To prevent overflow of aircraft reservoirs during ground test cart operation, position controls on test cart to isolate test cart reservoirs and operate test cart using aircraft reservoirs. If the above cannot be accomplished, adjust test cart return pressure to maximum of 45 psi.

When ground test cart operation is completed, replenish applicable aircraft reservoir(s) to normal fluid level as specified on RESERVOIR SERVICING placard (Ref. 12-13-01).

(6) Shut down hydraulic ground test cart.

(7) Turn off electrical power (Ref. 24-41-00).

(8) Disconnect hydraulic hoses from pressure and return quick disconnects, and reinstall dust caps on each quick disconnect.

(9) Remove hose support assembly from hoses and aft access door sill.

(10) Close and lock hydraulic service center doors.

E. Engine-driven Pumps

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed (Ref. Fig. 201):

HYD-PUMP & FIREWALL SHUTOFF VALVE CONT

SYS A (L15)

SYS B (L16)

SYS C (L17)

SYS D (L18)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that the following circuit breakers are closed:

HYDRAULIC - INDICATORS

QTY (M12)

PRESS (M13)

HYDRAULIC-QTY - TEMP - PRESS IND LT

SYS A

RSVR (M14)

PUMP (M15)

SYS B

RSVR (M16)

PUMP (M17)

SYS C

RSVR (M18)

PUMP (M19)

SYS D

RSVR (M20)

PUMP (M21)

AC PUMP B3 (L12)

PTU - CONT & IND

SYS B-A (L14)

SYS C-D (L15)

AC PUMP C3 (L22)

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

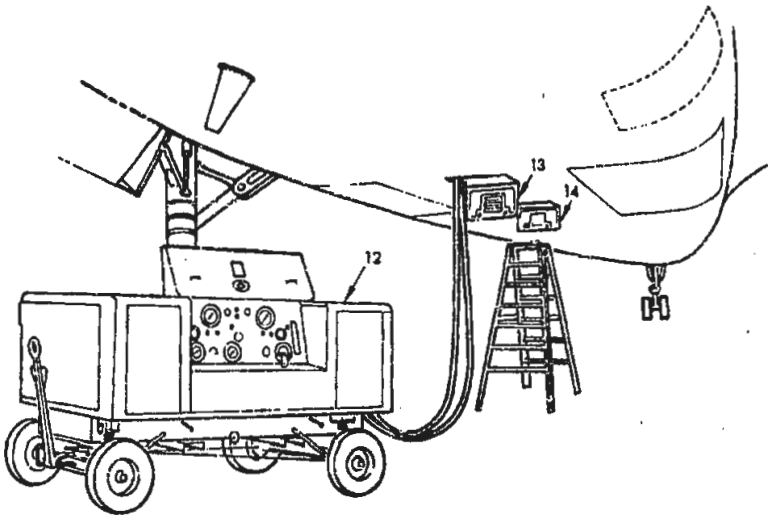
PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

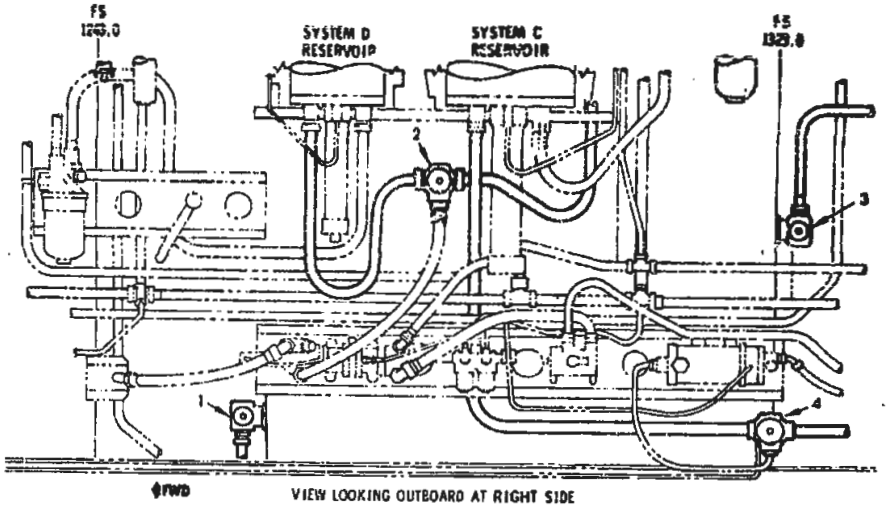
THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

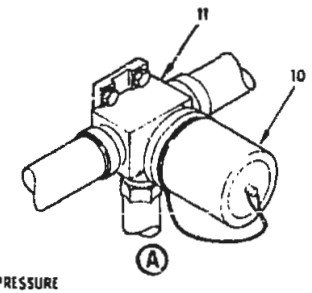
CAUTION: VERIFY THAT RESERVOIR PRESSURE OF APPROXIMATELY 65 PSI IS INDICATED ON THE APPLICABLE SYS RESERVOIR PRESSURE GAGE ON THE HYDRAULIC SERVICE PANEL BEFORE OPERATING REPLACED ENGINE DRIVEN PUMP.

(3) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, pressurize applicable hydraulic system using AC PUMPS or ATM and PTU switchlights (Ref. Para. 2).

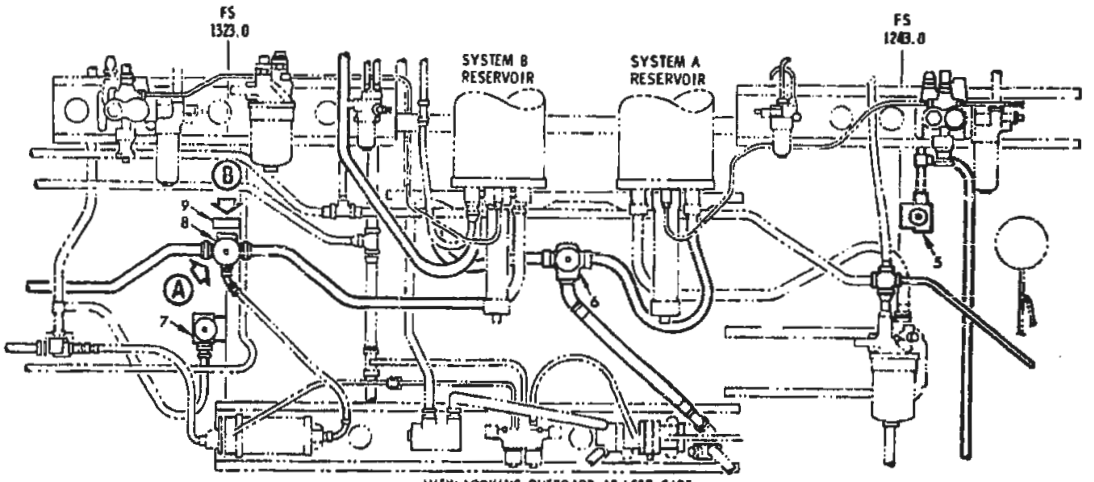
NOTE: The PTU operates on differential pressure between the motor and pump, and is "On Demand" operation. The PTU may not operate smoothly until approximately 3.5 gal/min flow demand is present. With flow demand less than 3.5 gpm







GROUND SERVICE-SYS B
RETURN - 85PSI
USE FLUID PER LOCKHEED SPEC
C-34-1224 TYPE II OR III
(B)



1 GROUND SERVICE FITTING, SYS D PRESSURE
2 GROUND SERVICE FITTING, SYS D RETURN
3 GROUND SERVICE FITTING, SYS C PRESSURE
4 GROUND SERVICE FITTING, SYS C RETURN
5 GROUND SERVICE FITTING, SYS A PRESSURE
6 GROUND SERVICE FITTING, SYS A RETURN
7 GROUND SERVICE FITTING, SYS B PRESSURE
8 GROUND SERVICE FITTING, SYS B RETURN
9 GROUND SERVICE CONNECTION PLACARD (TYPICAL 8 PLACES)
10 PROTECTIVE CAP
11 GROUND SERVICE FITTING (TYPICAL)
12 HYDRAULIC GROUND TEST CART (3000 PSI, 40 GPM)
13 HYDRAULIC SERVICE CENTER AFT ACCESS DOOR (147BB)
14 HYDRAULIC SERVICE CENTER FORWARD ACCESS DOOR (147AB)

HYDRAULIC SERVICE CENTER

G 434
MI 0100-29-115

Hydraulic System Pressurization (Using Hydraulic Ground Test Cart)
Figure 202

system pressure fluctuations in the range of 2200 to 3500 psi may exist and is normal.

(4) On HYDRAULIC SYSTEM panel, lift guard and depress (latch in) applicable PUMP S/O switchlight (flowbar on) and verify that SUCT S/O switchlight is also latched in (flowbar on).

CAUTION: WITH ALL MAINTENANCE PROCEDURES BEING ADHERED TO AT ENGINE START, IF ENGINE-DRIVEN PUMP FAILS TO PRIME WITHIN TWO MINUTES AFTER COMPLETION OF ENGINE START CYCLE (PUMP OUTLET LO PR LIGHT DOES NOT GO OUT), SHUT DOWN ENGINE AND REPLACE PUMP.

(5) Start engine (Ref. 71-00-00).

(6) Operate engine at idle or above.

(7) Verify that applicable system PUMP OUTLET LO PR indicator light goes out.

(8) Verify that the applicable hydraulic system pressure (no control flow) stabilizes between 2700 and 3150 psi.

(9) Release AC PUMPS and PTU switchlights.

(10) When system hydraulic pressure requirements are complete, shut down engine (Ref. 71-00-00).

(11) Turn off electrical power (Ref. 24-41-00).

5. Hydraulic System Bleeding

A. General

CAUTION: THROUGHOUT THE FOLLOWING BLEEDING PROCEDURES CYCLE AILERON AND RUDDER CONTROL SURFACES SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP) TO PREVENT DAMAGE TO CONTROL SURFACE DAMPERS.

After removal and replacement of any component, hose or tube, the air introduced to hydraulic systems should be bled by the following procedure:

(1) Leave the last hydraulic connection finger-tight.

(2) Apply 50 to 100 psi pressure to area being bled.

NOTE: For the return, suction and case drain lines, this can be done by turning on the AC pump and PTU as applicable.

(3) When hydraulic fluid flows through the loose connection, shut off hydraulic pressure and immediately tighten the loose connection.

(4) Perform applicable reservoir fill, air check and air bleed procedures in accordance with RESERVOIR SERVICE INSTRUCTIONS placard (Ref. Fig. 203).

The AIR BLEED procedure on the reservoir instruction plate is adequate for component replacement where the air will be returned directly to the reservoir. For components which would tend to distribute the air throughout the system, additional bleeding is required as follows:

System A and C - Operate flaps

System B - Operate flaps using B-A PTU

System D - Operate ailerons

All other hydraulic subsystems not affected or used should be shut off. The final step of any bleeding operation is to fill and bleed the reservoir in accordance with the reservoir instruction plate.

If air entrainment or entrapment is still indicated after performing reservoir air bleed, a system bleeding procedure may be required. Paragraphs B through E provide detailed bleeding procedures for systems A, B, C, and D respectively.

B. System A Bleeding Procedure

(1) On pilots overhead PFCS panel, verify that all flight control servos are on (Ref. Fig. 203).

(2) Turn on B2 ATM pump (Ref. Para. 4).

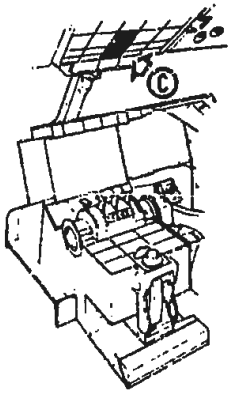
(3) Turn on B-A PTU.

(4) Below the HYDRAULIC SERVICE PANEL, zone 147, verify that the System A Rudder Fusing System panel indicator light is out (press-to-test to verify that light is operative).

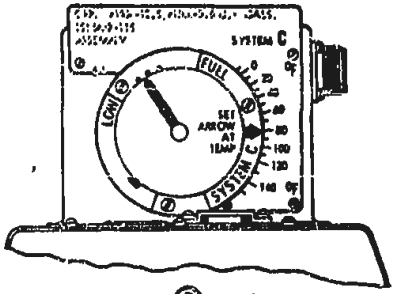
(5) Operate the rudder 10 full cycles.

(6) Operate the tail skid two full cycles as follows:

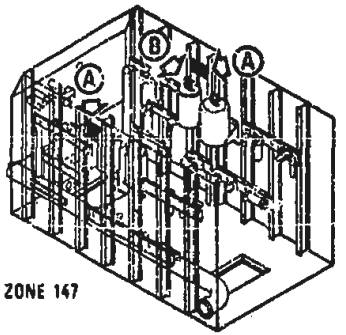
(a) On aft fuselage forward of tail skid (FS 1986), open access door to tail skid control switch.



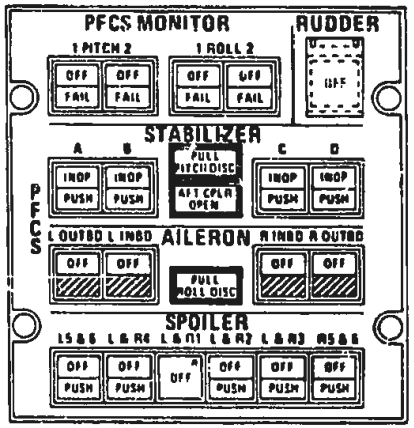
FLIGHT STATION
ZONE 210



(B)
(TYP 4 PLACES)

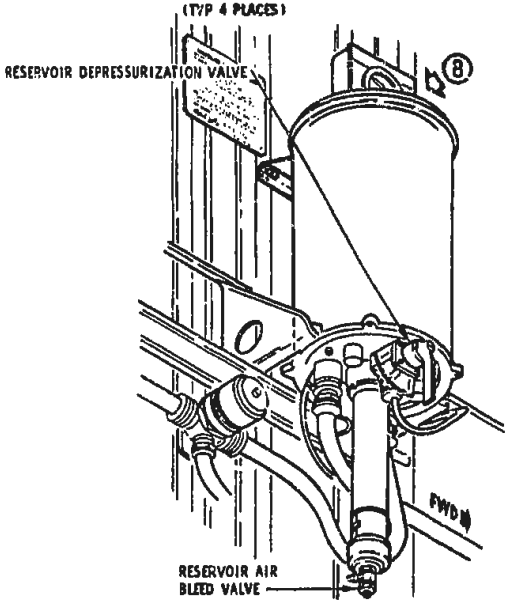


ZONE 147



(C)

PILOTS OVERHEAD PFCS PANEL



HYDRAULIC RESERVOIR
(TYP 4 PLACES)

RESERVOIR SERVICE INSTRUCTIONS

NOTICE: RESERVOIR GAGE WILL SHOW TRUE QUANTITY OF FLUID ONLY WHEN SYSTEM IS PRESSURIZED & DIAL SET AT FLUID TEMPERATURE

FLUID QUANTITY CHECK

- PRESSURIZE HYDRAULIC SYSTEM PER SERVICE PANEL INSTRUCTIONS
- OBSERVE SYSTEM FLUID TEMPERATURE ON SERVICE PANEL GAGE
- TURN RESERVOIR DIAL TO FLUID TEMPERATURE WHICH WAS OBSERVED
- IF DIAL NEEDLE IS: IN **RED** ZONE, - PERFORM **FILL** AS NOTED BELOW
  IN **GREEN** ZONE, - PERFORM **AIR CHECK**
  IN **YELLOW** ZONE, - PERFORM **OVERFILL DRAIN**

FILL

- CONNECT GROUND SERVICE CART TO SERVICE PANEL COUPLING
- PRESSURIZE HYDRAULIC SYSTEM PER SERVICE PANEL INSTRUCTIONS
- TURN RESERVOIR DIAL TO FLUID TEMPERATURE
- FILL AT ABOUT 1.0 GPM UNTIL RESERVOIR DIAL NEEDLE IS AT **FULL**

AIR CHECK

- PRESSURIZE HYDRAULIC SYSTEM PER SERVICE PANEL INSTRUCTIONS
- TURN RESERVOIR DIAL TO ALIGN LEFT DOT IN GREEN ZONE WITH NEEDLE
- WHILE OBSERVING DIAL OPERATE DEPRESSURIZATION VALVE AT BASE
  - IF ROTARY VALVE, TURN RAPIDLY 60° TO STOP & RELEASE
  - IF PUSH BUTTON VALVE, DEPRESS FULLY & RELEASE
- IF NEEDLE SWEEPS PAST ANOTHER DOT, PERFORM **AIR BLEED** BELOW

AIR BLEED

- CONNECT TRANSPARENT HOSE TO AIR BLEED VALVE NIPPLE
- PRESSURIZE HYDRAULIC SYSTEM PER SERVICE PANEL INSTRUCTIONS
- DEPRESS AIR BLEED VALVE BUTTON UNTIL FLUID IN HOSE RUNS CLEAR
- PERFORM **AIR QUANTITY** AND **FLUID QUANTITY CHECKS**

OVERFILL DRAIN

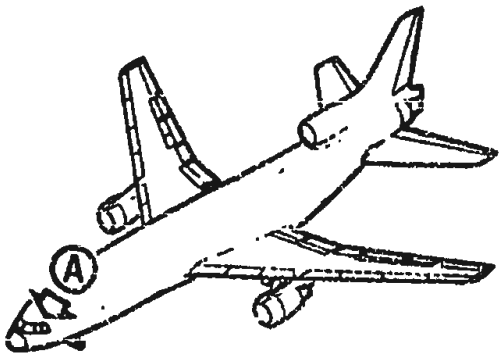
- SET RESERVOIR DIAL AT FLUID TEMPERATURE. PERFORM **AIR BLEED** EXCEPT DEPRESS BUTTON UNTIL GAGE NEEDLE IS AT **FULL** MARK

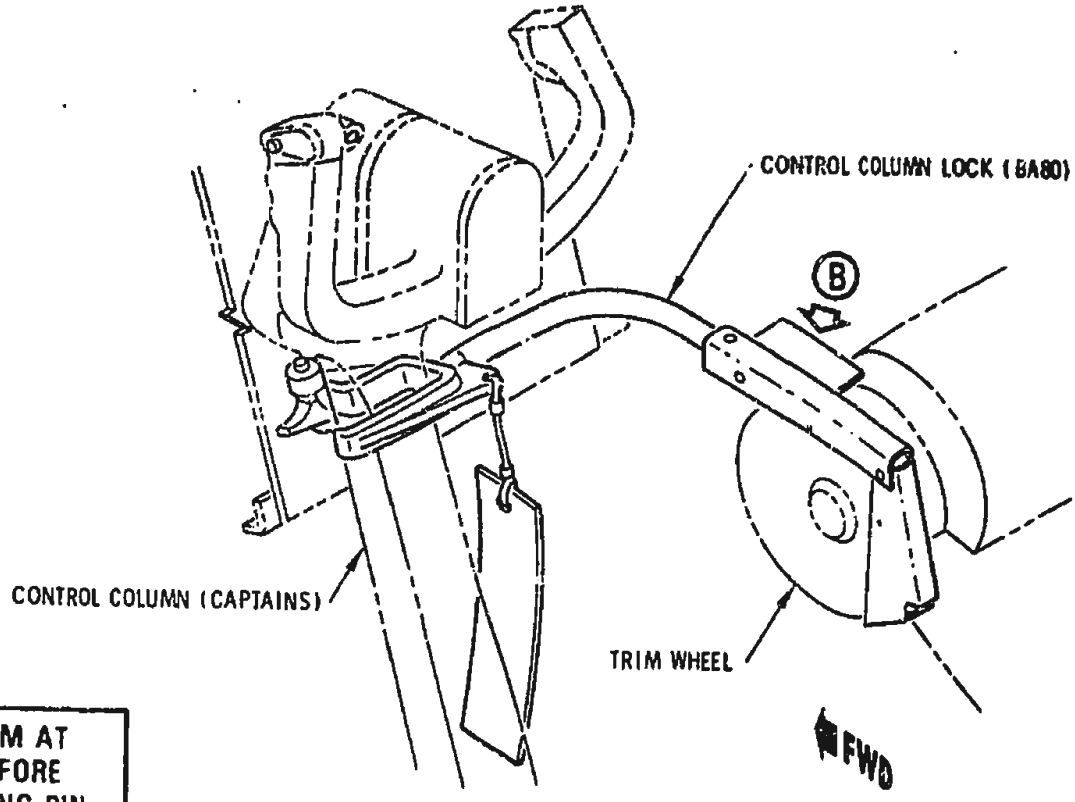
(A)

RESERVOIR SERVICE INSTRUCTIONS PLACARD (TYP 2 PLACES)

M1-36202-29-290

Hydraulic System Bleeding Component Locator
Figure 203





SET TRIM AT "0" BEFORE INSTALLING PIN

– WARNING –

CLOSE #2 ENGINE UPPER COWL PANEL LATCHES BEFORE REMOVING PIN

B

M1-0000-54-089

R
R

Control Column and Trim Wheel Lock
Figure 204

(b) Operate tail skid switch two complete extend/retract cycles.

(7) Operate the stabilizer through five full cycles at a rate of 2 seconds, stop to stop.

(8) Operate the depressurization valve on system A reservoir in accordance with Paragraph 1B for approximately 1/2 minute. Release and verify that reservoir pressure returns to 70-85 psi.

(9) Perform reservoir AIR CHECK and AIR BLEED in accordance with RESERVOIR SERVICE INSTRUCTIONS (Ref. Fig. 203). If excessive air is still indicated proceed to Step (10).

(10) Motor No. 1 engine (Ref. 71-00-00).

(11) Operate aileron control wheel through five full cycles.

(12) Stop engine motoring.

(13) Operate speed brakes through 10 cycles.

(14) Operate slats and flaps through 1 cycle.

(15) Operate reservoir depressurization valve and hold for approximately 1/2 minute.

(16) Perform reservoir AIR CHECK and AIR BLEED in accordance with RESERVOIR SERVICE INSTRUCTIONS (Ref. Fig. 203). If excessive air is still indicated shut off system A hydraulic pressure and allow air to settle out for 5 minutes minimum, then repeat Steps 5B(5) through 5B(16) as required to reduce air indication to one dot needle travel on the reservoir quantity gage (Ref. AIR CHECK on RESERVOIR SERVICE INSTRUCTIONS, Fig. 203).

(17) Turn off hydraulic power.

C. System B Bleeding Procedure

(1) On pilots overhead PFCS panel, position all flight control SERVOS to OFF or INOP.

(2) Turn on B3 AC PUMP (Ref. Para. 4).

(3) Turn on B-A PTU.

(4) Motor No. 2 engine (Ref. 71-00-00).

(5) Operate flaps and slats through one cycle while motoring the engine.

(6) Stop motoring the engine, shut off B-A PTU and shut off B3 AC PUMP.

(7) On pilots overhead PFCS panel, turn on all flight control servos.

(8) Turn on B2 ATM pump (Ref. Para 4).

(9) Operate the rudder 10 cycles.

(10) Operate the stabilizer 5 cycles at a rate of 2 seconds, stop to stop.

(11) Operate system B reservoir depressurization valve in accordance with Paragraph 1B for 1/2 minute. Release and verify that reservoir pressure returns to 70-85 psi.

(12) Perform reservoir AIR BLEED and AIR CHECK in accordance with RESERVOIR SERVICE INSTRUCTIONS (Ref. Fig. 203). If excessive air is still indicated, proceed to Step 5C(13).

(13) Operate the speedbrakes 5 cycles.

(14) Operate aileron control wheel 5 cycles.

(15) Select NORMAL brakes and turn off the B2 ATM pump.

(16) Cycle the brake pedals until NORMAL brake accumulator is completely discharged.

(17) Turn on the B3 AC Pump.

(18) Operate reservoir depressurization valve and hold for approximately 1/2 minute.

(19) Perform reservoir AIR BLEED and AIR CHECK (Ref. Fig. 203). If excessive air is still indicated, shut off sysytem B hydraulic pressure and allow air to settle out for 5 minutes minimum, then repeat Steps 5C(1) through 5C(18) as required to reduce air indication to one dot needle travel on the reservoir quantity gage.

(20) Turn off hydraulic power.

D. System C Bleeding Procedure

(1) On pilots overhead PFCS panel, verify that all flight control servos are OFF or INOP.

(2) Turn on AC PUMP C3 (Ref. Para. 4).

(3) Motor No. 2 engine (Ref. 71-00-00).

(4) Operate flaps and slats one cycle while motoring the engine.

(5) Stop motoring the engine and shut off AC PUMP C3.

(6) On pilots overhead PFCS panel, turn on all flight control servos.

(7) Turn on C2 ATM pump (Ref. Para. 4).

(8) Operate rudder 10 cycles.

(9) Operate stabilizer 5 cycles at a rate of 2 seconds, stop to stop.

(10) Operate system C reservoir depressurization valve in accordance with Paragraph 1B for 1/2 minute. Release and verify that reservoir pressure returns to 70-85 psi.

(11) Perform reservoir AIR BLEED and AIR CHECK in accordance with RESERVOIR SERVICE INSTRUCTIONS (Ref. Fig. 203). If excessive air is still indicated, proceed to Step 5D(12).

(12) Operate speed brakes through 5 cycles.

(13) Operate aileron control wheel through 5 cycles.

(14) Select ALTERNATE brakes and shutoff C2 ATM.

(15) Cycle the brake pedals until the alternate brake accumulator is completely discharged.

(16) Turn on C3 AC pump.

(17) Operate reservoir depressurization valve and hold for approximately 1/2 minute.

(18) Perform reservoir AIR BLEED and AIR CHECK (Ref. Fig. 203). If excessive air is still indicated, shut off system C hydraulic pressure and allow air to settle out for 5 minutes minimum. If the excess air is slight, repeat Steps 5D(1) through 5D(17). If the volume of

air shows 2 dots needle travel during AIR CHECK proceed to step 5D(19).

(19) Jack the airplane (Ref. 7-11-00).

(20) Turn on C2 ATM pump.

(21) Operate the landing gear through 2 cycles.

(22) Operate reservoir depressurization valve and hold for approximately 1/2 minute.

(23) Perform reservoir AIR BLEED and AIR CHECK to test for air in the system. If air indication is still excessive, shut off hydraulic pressure and allow air to settle out for 5 minutes then repeat Steps 5D(1) through 5D(17) as required, to reduce air indication to one dot needle travel.

E. System D Bleeding Procedure

(1) On the pilots overhead PFCS panel verify that all servos are ON.

(2) Turn on C2 ATM pump (Ref. Para. 4).

(3) Turn on C-D PTU.

(4) Operate stabilizer through 5 cycles at a rate of 2 seconds, stop to stop.

(5) Operate system D reservoir depressurization valve in accordance with Paragraph 1B for 1/2 minute. Release and verify that reservoir pressure returns to 70-85 psi.

(6) Perform reservoir AIR BLEED and AIR CHECK in accordance with RESERVOIR SERVICE INSTRUCTIONS (Ref. Fig. 203). If air indication is still excessive, proceed to Step 5E(7).

(7) Motor No. 3 engine (Ref. 71-00-00).

(8) Shut off C2 ATM and C-D PTU.

(9) Pull up and lock aileron roll disconnect handle on center console. Operate First Officers aileron control wheel through 6 full cycles while motoring the engine. Unlock and allow aileron roll disconnect handle to retract against center console.

(10) Stop motoring the engine.

(11) Turn on C3 AC pump.

(12) Turn on C-D PTU.

(13) Operate speed brakes through 10 cycles.

(14) Operate the system D reservoir depressurization valve and hold for approximately 1/2 minute.

(15) Perform reservoir AIR BLEED and AIR CHECK (Ref. Fig. 203). If excessive air is still indicated, shut off hydraulic pressure and allow air to settle out for 5 minutes minimum, then repeat Steps 5E(2) thru 5E(15) as required to reduce air to one dot needle travel.

6. HYDRAULIC SYSTEM FLUSHING AND FILTER REPLACEMENT REQUIREMENTS

Table 203

NO.	CONDITION	REQUIREMENTS
1.	Pump Failure without system contamination	A. If pump has been replaced, air bleed the system per paragraph 5 B. If pump has been replaced replenish system (Ref. 12-13-00) C. Flushing not required D. Filter element replacement not required
2.	Pump Failure with system contamination	A. Drain fluid out of lines and flush system per paragraph 7 B. Replace case drain pressure and return filter elements (Ref. 29-11-19 and 29-11-28) C. Reset differential pressure switch button if it has been actuated (Ref. 29-11-19) D. Air bleed the system per paragraph 5 E. Replenish the system (Ref. 12-13-00)

(Cont)
Table 203

NO.	CONDITION	REQUIREMENTS
3.	Pump Failure with system contamination and one of the following differential pressure switch indicators actuated: • Pressure filter • Case drain filter • Return filter	A. Drain fluid out of lines and flush system per paragraph 7 B. Replace case drain, pressure and return filter elements (Ref. 29-11-19 and 29-11-28) C. Reset differential pressure switch button D. Airbleed the system per paragraph 5 E. Replenish the system (Ref. 12-13-00)
4.	Pump Failure caused by stuck check valve (system contaminated)	A. Replace stuck check valve B. Drain fluid out of lines and flush system per paragraph 7 C. Replace case drain, pressure and return filter elements (Ref. 29-11-19 and 29-11-28) D. Reset differential pressure switch button if it has been actuated (Ref. 29-11-19) E. Airbleed the system per paragraph 5 F. Replenish the system (Ref. 12-13-00)
5.	Pump Failure caused by filter collapse or rupture (system contaminated)	A. Replace filter element B. Drain fluid out of lines and flush system per paragraph 7 C. Reset differential pressure switch button if it has been actuated (Ref. 29-11-19)

(Cont)
Table 203

NO.	CONDITION	REQUIREMENTS
		D. Air bleed the system per paragraph 5
	3 E. Replenish the system (Ref. 12-13-00)	
6.	Pump overheat caused by loss of hydraulic fluid	A. Check pressure, case drain and supply hose fittings for leakage
		B. Check for damaged hoses and replace as necessary
		C. Flush pressure and case drain hoses between pump and filter per paragraph 7.
		D. Replace pressure and case drain filter elements (Ref. 29-11-19 and 29-11-28)
		E. Reset differential pressure switch button if it has been actuated (Ref. 29-11-19)
		F. Air bleed system per paragraph 5
		G. Replenish the system (Ref. 12-13-00)
7.	Filter collapse or rupture (no pump failure)	A. Replace filter element
		B. Air bleed the system per paragraph 5
		C. Replenish the system (Ref. 12-13-00)
		D. Flushing not required
8.	System opened for component replacement or general repair	A. Air bleed the system per paragraph 5

(Cont)
Table 203

NO.	CONDITION	REQUIREMENTS
		B. Replenish the system (Ref. 12-13-00)
		C. Flushing not required

7. System Fluid Flushing

The following procedures are intended to replace the system fluid with minimum waste. Quiescent flow through the servos is continuous, therefore system operation between component cycling will use additional fluid. If a delay in cycling sequence is encountered, shut off the hydraulic test cart until the sequence can be continued.

The hydraulic test cart reservoir fluid level must be monitored during flushing procedure to prevent air being introduced into the lines. Systems A, B, and D will each use approximately 30 gallons. System C will use approximately 70 gallons; test cart reservoir must be refilled during system C flushing procedures.

CAUTION: CYCLING FLIGHT CONTROLS AT HIGH RATES DURING GROUND OPERATIONS (NO AIR LOADS) CAN DAMAGE FLUTTER DAMPER SEALS. CYCLE CONTROLS SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

A. Preparation

NOTE: Systems A, B, C, and D have a priority valve and accumulator in the reservoir pressurization system to provide auxiliary reservoir pressurization during engine pump depressurized (EDV) mode.

WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

Prior to opening any line pressurized by an accumulator, the accumulator pressure must be bled off. This is accomplished by operating the reservoir depressurization valve at the base of the reservoir until applicable SYS RESERVOIR PRESSURE GAGE on HYDRAULIC SERVICE PANEL indicates zero psi.

(1) Verify that test cart reservoir is filled with clean (class 5) LAC Spec C-34-1224 fluid.

(2) Verify that ram air turbine (RAT) ground safety lock bar is installed across RAT doors.

(3) On pilots overhead circuit breaker panel CB1, zone 215, open and tag circuit breakers as follows:

RAT AUTO DEPLOY (L3)

RAT MAN DEPLOY (B14)

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

INDICATORS - QTY (M12)

INDICATORS - PRESS (M13)

AC PUMP B3 (L12)

PTU CONT & IND SYS B-A (L14)

PTU CONT & IND SYS C-B (L15)

AC PUMP C3 (L22)

TAIL SKID CONT (F12)

TAIL SKID IND (F13)

(4) Verify that all flight controls are operative.

B. System A Fluid Flushing

(1) Perform preparation procedures described in Paragraph 7A.

CAUTION: USE EXTREME CARE TO SUPPORT THE HYDRAULIC TEST CART HOSE FROM AIRCRAFT STRUCTURE TO PREVENT DAMAGE TO HYDRAULIC HOSE ASSEMBLIES DUE TO SHARP BENDING OR KINKING.

(2) Gain access to hydraulic hose self-sealing disconnects for engine-driven pump A1 or engine No. 1 by opening cowl panels 413 and 414. Connections are on upper right side of engine (QEC bracket).

(3) Disconnect pressure and suction self-sealing disconnect fittings. Place protective caps on bracket-mounted fittings.

(4) Connect test cart pressure hose (with adapters) to the aircraft system pump pressure hose self-sealing fitting.

(5) Connect hose from used fluid container to the aircraft system pump suction hose self-sealing fitting.

(6) Check the applicable system return filter pop-up indicator. If indicator is extended, replace filter element to prevent system contamination (Ref. 29-11-22).

(7) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on hydraulic test cart; adjust test cart return pressure to 45 psi (Max), system pressure to 3000 psi, and flow to 20 gpm.

(9) Slowly operate stabilizer through 4 complete cycles.

(10) Slowly operate rudder through 4 complete cycles.

(11) Extend and retract tail skid as follows:

(a) On aft fuselage forward of the tail skid (FS 1986), open access door to tail skid control switch.

(b) With pressure on system A, operate switch to cycle tail skid 6 times. Close control switch access door.

(12) Extend flaps and slats.

(13) Operate ailerons through 20 full cycles.

(14) Retract flaps and slats.

(15) Shut off hydraulic test cart pressure.

(16) Disconnect test cart and used fluid hoses from aircraft pressure and suction hose self-sealing fittings.

(17) Remove protective caps from fittings at engine QEC point and reconnect the suction and pressure hose self-sealing fittings.

(18) Close engine cowl panels.

(19) Replace applicable pressure, return, and case drain filter elements if fluid inspection indicates particulate contamination, or if clogged filter pop-up indicator has extended (Ref. 29-11-19, 29-11-22, 29-11-28).

(20) Refill system A reservoir and perform AIR BLEED in accordance with RESERVOIR SERVICING INSTRUCTIONS placard (Ref. 12-13-01).

(21) Turn off electrical power (Ref. 24-41-00).

C. System B Fluid Flushing

(1) Perform preparation procedures described in Paragraph 7A.

CAUTION: USE EXTREME CARE TO SUPPORT THE WEIGHT OF HYDRAULIC TEST CART HOSE FROM AIRCRAFT STRUCTURE TO PREVENT DAMAGE TO HYDRAULIC PUMP PRESSURE AND SUCTION HOSES DUE TO SHARP BENDING OR KINKING.

(2) Gain access to hydraulic hose self-sealing disconnect fittings for engine-driven pump B1 by opening left and right lower hinged cowl panel on No. 2 engine. The fittings are at lower QEC disconnect bracket on lower left side of engine.

(3) Disconnect pressure and suction self-sealing disconnect fittings. Place protective caps on bracket-mounted fittings.

(4) Connect test cart pressure hose (with adapters) to the aircraft system pump pressure hose self-sealing fitting.

Connect hose from used fluid container to the aircraft system pump suction hose self-sealing fitting.

(5) Check the applicable system return filter pop-up indicator. If the indicator is extended, replace filter element to prevent system contamination (Ref. 29-11-22).

(6) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic test cart; adjust test cart return pressure to 45 psi (Max), system pressure to 3000 psi and flow to 20 gpm.

(8) Operate the rudder through 3 complete cycles.

(9) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, turn on B-A PTU.

NOTE: Turning on B-A PTU allows flap and slat operation to create a desirable high flow demand in system B which facilitates flushing.

(10) Extend flaps and slats full down.

(11) Operate speed brake through 11 complete cycles.

(12) Operate ailerons through 10 complete cycles.

(13) Turn off hydraulic test cart.

(14) Pump brakes until B brake pressure drops to zero psi.

(15) Turn on hydraulic test cart until B brake pressure reaches 3000 psi.

(16) Repeat Steps (13), (14), and (15).

(17) Operate ailerons through 9 additional cycles.

(18) Retract flaps and slats.

(19) Turn off B-A PTU.

(20) Operate stabilizer through 2 complete cycles.

(21) Turn off hydraulic test cart.

(22) Disconnect test cart and used fluid hoses from aircraft pressure and suction hose self-sealing fittings.

(23) Remove protective caps from bracket-mounted pressure and suction hose fittings and reconnect self-sealing fittings.

(24) Replace applicable pressure, return, and case drain filter elements if fluid inspection indicates particulate contamination, or if clogged filter pop-up indicator has extended (Ref. 29-11-19, 29-11-22, 29-11-28).

(25) Close engine cowl panels.

(26) Refill system B reservoir and perform AIR BLEED in accordance with RESERVOIR SERVICING INSTRUCTIONS placard (Ref. 12-13-01).

(27) Turn off electrical power (Ref. 24-41-00).

D. System C Fluid Flushing

(1) Perform the preparation procedures described in Paragraph 7A and the additional special preparations as follows:

(a) Install wing and fuselage jacks to permit main and nose landing gear cycling (Ref. 7-11-00).

(b) Verify that the MLG doors are operative and clear of all equipment.

CAUTION: USE EXTREME CARE TO SUPPORT THE WEIGHT OF HYDRAULIC TEST CART HOSE FROM AIRCRAFT STRUCTURE TO PREVENT DAMAGE TO HYDRAULIC PUMP PRESSURE AND SUCTION HOSES DUE TO SHARP BENDING OR KINKING.

(2) Gain access to hydraulic hose self-sealing disconnect fittings for engine-driven pump C1 by opening left and right lower hinged cowl panels on No. 2 engine. The

fittings are at lower QEC disconnect bracket on lower right side of engine.

(3) Disconnect pressure and suction hose self-sealing disconnect fittings. Place protective caps on bracket-mounted fittings.

(4) Connect test cart pressure hose (with adapters) to the aircraft system pump pressure hose self-sealing fitting.

(5) Connect hose from used fluid container to the aircraft system pump suction hose self-sealing fitting.

(6) Check the applicable system return filter pop-up indicator. If indicator is extended, replace filter element to prevent system contamination (Ref. 29-11-22).

(7) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on hydraulic test cart; adjust test cart return pressure to 45 psi (Max), system pressure to 3000 psi, and flow to 20 gpm.

(9) Operate rudder through 3 complete cycles.

(10) Operate nose wheel steering through 3 complete cycles using handwheel.

(11) Extend flaps and slats full down.

(12) Operate ailerons through 19 complete cycles.

(13) Retract flaps and slats.

(14) Turn off system C pressure (hydraulic test cart).

(15) Select alternate brakes.

(16) Pump brakes until alternate brake pressure is zero (accumulator discharged).

CAUTION: ESTABLISH INTERPHONE CONTACT BETWEEN COCKPIT AND BOTH MLG AREAS WITH OBSERVERS WATCHING LANDING GEAR AND DOORS.

(17) Remove landing gear downlock safety pins and door safety devices.

(18) Turn on System C pressure (hydraulic test cart).

(19) Operate landing gear handle from DOWN to UP to DOWN 3 times, allowing time for landing gear to go full cycle.

CAUTION: UPON COMPLETION OF LANDING GEAR CYCLE TEST, VERIFY THAT LANDING GEAR HANDLE IS IN THE DOWN POSITION.

(20) Operate stabilizer through 2 complete cycles.

(21) Turn off hydraulic test cart.

(22) Install landing gear downlock safety pins and door safety devices.

(23) Remove wing and fuselage jacks (Ref. 7-11-00).

(24) Disconnect hydraulic test cart pressure hose and the used fluid hose from pressure and suction self-sealing disconnect fittings.

(25) Remove protective caps from QEC disconnect fittings and reconnect the pressure and suction hoses.

(26) Replace applicable system pressure, return, and case drain filter elements if fluid inspection indicates particulate contamination, or if clogged filter pop-up indicator has extended (Ref. 29-11-19, 29-11-22, 29-11-28).

(27) Close lower hinged cowl panels.

(28) Refill system C hydraulic reservoir and perform AIR BLEED in accordance with RESERVOIR SERVICING INSTRUCTIONS placard (Ref. 12-13-01).

(29) Turn off electrical power (Ref. 24-41-00).

E. System D Fluid Flushing

(1) Perform preparation procedures described in Paragraph 7A.

CAUTION: USE EXTREME CARE TO SUPPORT THE WEIGHT OF HYDRAULIC TEST CART HOSE FROM AIRCRAFT STRUCTURE TO PREVENT DAMAGE TO HYDRAULIC PUMP PRESSURE AND SUCTION HOSES DUE TO SHARP BENDING OR KINKING.

(2) Gain access to hydraulic hose self-sealing disconnects for engine No. 3 by opening cowl panels 423 and 424. Connections are on upper right side at engine (QEC bracket).

(3) Disconnect pressure and suction self-sealing disconnect fittings. Place protective caps on bracket-mounted fittings.

(4) Connect test cart pressure hose (with adapters) to the aircraft system pump pressure hose self-sealing fitting.

(5) Connect hose from used fluid container to the aircraft system pump suction hose self-sealing fitting.

(6) Check the applicable system return filter pop-up indicator. If indication is extended, replace filter element to prevent system contamination (Ref. 29-11-22).

(7) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on hydraulic test cart and adjust test cart return pressure to 45 psi (Max), system pressure to 3000 psi, and flow to 20 gpm.

(9) Operate ailerons through 20 complete cycles.

(10) Operate stabilizer through 9 complete cycles.

(11) Turn off hydraulic test cart.

(12) Disconnect hydraulic test cart pressure hose from self-sealing fitting and the used oil hose from suction line self-sealing fitting.

(13) Remove protective caps from QEC disconnect fittings and reconnect the pressure and suction hoses.

(14) Replace applicable pressure, return, and case drain filter elements if fluid inspection indicates particulate contamination, or if clogged filter pop-up indicator has extended (Ref. 29-11-19, 29-11-22, 29-11-28).

(15) Close engine cowl panels.

(16) Refill system D reservoir and perform AIR BLEED in accordance with RESERVOIR SERVICING INSTRUCTIONS placard (Ref. 12-13-01).

(17) Turn off electrical power (Ref. 24-41-00).

C 8. Hydraulic System Failure

C A. Hydraulic Fluid Loss

C (1) If EDP suction shutoff in excess of 2 minutes, replace
C EDP and associated case drain and pressure filter
C elements, and flush the lines from the pumps to the
C filters.

C (2) If EDP depressurized (pump shutoff) and operated with
C zero fluid in the reservoir, proceed as in (1). No
C time limit depressurized with fluid in the reservoir.

C (3) If hydraulic leak is between reservoir and pump so that
C pump can ingest air, proceed as in (1).

C (4) If ATM operated with zero fluid in the reservoir
C replace ATM pump and associated pressure and case drain
C filters.

C (5) If A/C pump operated with zero fluid in the reservoir,
C replace pump and associated pressure and case drain
C filters.

C C C (6) If PTU operated with zero fluid in the reservoir, replace PTU and associated pressure and case drain filters.

C C (7) If engine shut-down in flight and EDP suction by switch or firepull handle, proceed as in (1).

C C C B. After correcting cause of system failure, operate ailerons, spoilers, elevators, and rudders a minimum of 10 cycles each to bleed system. Assure EDP and ATM operation is normal.

9. Hydraulic Pump Line Flushing

The following procedure flushes hydraulic pump pressure and case drain lines. The procedure is intended for use in conjunction with replacement of a failed electric motor or air turbine motor-driven hydraulic pump (Ref. 29-11-08, 29-11-71). The detailed hydraulic line flushing procedures for failed engine-driven pumps is called out in the engine-driven hydraulic pump removal and installation procedure (Ref. 29-11-07).

A. Flushing Procedure

CAUTION: USE EXTREME CARE TO SUPPORT THE HYDRAULIC TEST CART HOSE FROM AIRCRAFT STRUCTURE TO PREVENT DAMAGE TO PUMP HOSE ASSEMBLIES DUE TO SHARP BENDING OR KINKING.

(1) Connect test cart pressure hose (with adapters) to the disconnected pump end of the pressure hose.

(2) Connect hose from used fluid container to the disconnected pump end of the case drain hose.

(3) Gain access to pump pressure and case drain filters by opening the hydraulic service center, zone.

(4) Remove high-pressure filter housing and case drain filter, then attach jumper hoses between pressure and case drain lines (Ref. 29-11-14 and 29-11-23). For ATM pump case drain line, remove quiescent flow meter (QFM) and install jumper hose.

(5) Operate hydraulic test cart at 5 gpm (min) for 2 minutes to flush pressure and case drain lines.

(6) Shut down test cart.

(7) Disconnect test cart and used fluid container hoses. Connect aircraft pressure hose to pump ensuring that hose is full of hydraulic fluid.

(8) Remove jumper hose and reconnect pressure and case drain filters to aircraft system.

(9) Remove pressure and case drain filter elements and replace with new elements (Ref. 29-11-19, 29-11-28).

(10) Remove QFM jumper hose; clean QFM and reinstall. Do not disturb QFM transducer adjustment.

C 10. Ground Restrictions On EDP Operation

C A. Ground check of suction shutoff valves with engines running, C 30 seconds "off" maximum.

C B. Ground depressurization of pumps with engines running, no C time limit.

C 11. Tubing Failures - Ground Service Disconnect

C A. A Lockheed Service Information letter advises that several C tubing failures in the ground service disconnect area have C been caused by improper installation of the bracket assembly C to which the disconnect fitting is attached. This caused C misalignment of the plumbing. Removing the brackets and C installing them properly corrected the condition. A new C mounting bracket with slotted holes, P/N 1585769-105, is C installed on later airplanes. Disconnect fitting locations C are shown in Maintenance Manual 29-00-00, Figure 8, Sheets 2 C and 3 and IPC 29-11-17, Figure 1 and 29-11-35, Figure 1 .

CR 12. Hydraulic Fluid Loss - Reservoir Pressure Relief Valve

C A. The reservoir pressure relief valve may relieve fluid C overboard during system operation due to a failed reservoir C pressurization priority valve. This fluid loss is not C always readily apparent. When fluid loss cannot be noted it C will be advisable to make the following check.

C B. Check reservoir priority valve.

C (1) Depressurize the reservoir and check air charge in the C reservoir accumulator.

C (2) Pressurize hydraulic system, pressure should read C approximately 3000 PSI on accumulator gage.

C (3) Turn hydraulic pump off, accumulator gage should drop C immediately to about 1900 PSI and hold at that point.

C (4) Failure to drop to 1900 PSI indicates a failed priority
C valve which will require replacement.

C C. A failed priority valve causes a pressure build-up in the
C reservoir during operation which will open the reservoir
C pressure relief valve.

CR 13. Hydraulic System Pressures and External Leakage Limits

C A. Engine Driven Pumps (EDP) Systems A, B, C, D 3000 ± 150 psi.

C B. Air Turbine Motor (ATM) Pumps 3000 ± 150 psi with A & D
C PTU's off.

C NOTE: ATM pressure may fluctuate with PTU's on due to
C internal leakage in hydraulic systems and efficiency
C loss through the PTU.

C C. AC Motor-driven Pumps

C AC motor-driven pumps pressurize hydraulic systems B and C
C and, by use of power transfer units (PTU), systems A and D.
C System A and D pressure will be approximately 300 psi below
C normal due to mechanical loss through the PTU.

C Table 201 lists the minimum AC pump pressure acceptable for
C various combinations of PTU amd servo valve activation.
C Servo valves are deactivated when switchlights on pilots
C overhead PFCS panel are released (out). Critical systems
C are the rudder, stabilizer, aileron, and spoiler. The only
C requirement is airplane on ground - all servo valves in
C Systems "A", "B", "C", and "D" on - PTU's on. Minimum
C pressure is: "A" - 900 PSI, "B" - 1300 PSI, "C" - 1700 PSI,
C and "D" - 1400 PSI.

CR D. Deleted

CR E. Deleted

HYDRAULIC POWER SYSTEM - INSPECTION AND CHECK

1. Inspection/Check

A. When returning to dual system operation from single system operation, fluid flow of up to 7.0cc from the rudder and left inboard aileron servos is normal.

B. Aircraft hydraulic system malfunctions other than obvious external leakage are usually indicated by sluggish or erratic component operation. One method of determining hydraulic system or component condition is by internal leakage measurement. By positioning aircraft controls as prescribed in the following procedures, system, subsystem and component flows are isolated. Resultant test recordings are then compared against prescribed tolerances to determine system or component condition.

Internal leakage procedures (Ref. Para. 4) are divided into two types of checks: Gross and detailed. Gross procedures (Ref. Para. 4) provide a means of checking each hydraulic system for gross internal leakage using aircraft AC pumps and pressure gages. Pressure readouts are dependent on pump delivery pressure compared to flow characteristics of the pump. Detailed procedures (Ref. Para. 5) require the use of a hydraulic power source other than the AC pump, and flow measuring devices of greater accuracy than pressure indications based on the output of the AC pump. Normally, detailed leakage checks are performed whenever component leak isolation is necessary.

External hydraulic leakage checks are provided to aid in determining the general condition of the hydraulic system in the area of pressure seals, fittings and plumbing installations. Leakage of any magnitude is not desirable but in some areas and certain components it can be tolerated
CR for a limited time in order to dispatch the aircraft (Ref.
CR 29-00-00, Para. 6).

Intersystem leakage checks are covered in Paragraph 7.

2. Equipment and Materials

Flowmeter, Industrial Measurements and Controls, Pomona, California, Model 410A-10A PDQ meter, or equivalent

Hydraulic Ground Power Units controllable to 0-15 gpm (flow) or greater while maintaining 3000 psi output pressure

3. Referenced Procedures

6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Gross Leakage Check

The maximum recommended gross internal leakage rate is 7 gpm for systems A, B, and C and 5.5 gpm for system D. Leakage rates greater than these can be detected using the output of the system B or C onboard AC pump. When system leakage rates exceed maximum, pump output pressure will be less than pressures indicated in Figure 601. This check is valid provided the AC pump output is not less than 3000 psi with all servos off (no-flow condition).

Pressure indications are to be read after system pressure has stabilized. If pressures do not stabilize and continue to fluctuate, the average of high and low pressures is used.

A. Preparation

(1) On pilots overhead circuit breaker panel CB1, zone 215, verify following circuit breakers are closed:

NO. 1 SYSTEMS

R YAW SAS (A5)

R PITCH & ROLL (A6)

R TRIM AGMT AC (A7)

R NO. 2 SYSTEMS

R YAW SAS (A23)

R PITCH & ROLL (A24)

TRIM AGMT AC (A25)

R AFCS MODE IND (31)

FCES - COMPUTERS DC (B4)

FCES - COMPUTERS AC & L AOA (B5)

FLIGHT CONTROL SYSTEM SERVO VALVES				PTU	MINIMUM HYDRAULIC SYSTEM PRESSURE PSIG			
A	B	C	D		A	B	C	D
-	OFF	OFF	-	OFF	-	3000	3000	-
-	ON	ON	-	OFF	-	2500	2500	-
ON	OFF	OFF	ON	ON	1750	2000	2300	2050
OFF	ON	ON	OFF	ON	2100	2500	2500	2100
ON	ON	ON	ON	ON	900	1300	1700	1400

NOTE

MAXIMUM ALLOWABLE QUIESCENT FLOW IS 7.0 GPM FOR SYSTEMS A, B AND C AND 5.5 FOR SYSTEM D. QUIESCENT FLOW WILL BE BELOW MAXIMUM ALLOWABLE IF ABOVE MINIMUM PRESSURES CAN BE MET.

M1-0000-29-015

Minimum AC pump output pressure
Figure 601

SPOILER DWELL - DC (B7)

SPOILER DWELL - AC (B8)

AFCS MODE IND (B19)

INSTR XFMR NO. 2 (D9)

R INS 3/GYRO 3 (E24)

INSTR XFMR NO. 1 (F5)

AIR DATA CMPTR (G8)

R INS/VERT GYRO (G24)

AIR DATA COMPTR (G27)

R NO. 2 ASYM BK

R LE SLAT (J10)

R TE FLAP (J11)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify following circuit breakers closed:

FLIGHT STATION MISC - R AOA (F1)

GEAR - GEAR CONT NO. 1 (F17)

GEAR - GEAR CONT NO. 2 (F18)

GEAR - NOSE STEERING (F19)

BRAKE - PARKING BRAKE NO. 1 (G18)

BRAKE - PRESS IND (G21)

BRAKE - PARKING BRAKE NO. 2 (G22)

NO. 1 ASYM BRAKE

TE FLAP (H21)

LE SLAT (H22)

HYDRAULIC

DLC SERVO - A (H14)

DLC SERVO - B (H15)

STABILIZER SERVO - LB (H16)

STABILIZER SERVO - RC (H17)

STABILIZER SERVO - LA (H18)

STABILIZER SERVO - RD (H19)

SPOILER SERVO - A2L (J15)

SPOILER SERVO - B1, 4, 6, L&R (J16)

SPOILER SERVO - C3, 5 L&R (J17)

SPOILER SERVO - D2R (J18)

AILERON SERVO - C INBD L&R (J19)

AILERON SERVO - A L INBD & OUTBD (J20)

AILERON SERVO - B L&R INBD & OUTBD (J21)

AILERON SERVO - D R INBD & OUTBD (J22)

RUDDER SERVO - A (K12)

RUDDER SERVO - B (K13)

RUDDER SERVO - C (K14)

AC PUMP - B3 (L12)

AC PUMP - C3 (L22)

INDICATORS - QTY (M12)

INDICATORS - PRESS (M13)

QTY TEMP PRESS IND LT

SYS A - RSVR (M14)

SYS A - PUMP (M15)

SYS B - RSVR (M16)

SYS B - PUMP (M17)

SYS C - RSVR (M18)

SYS C - PUMP (M19)

SYS D - RSVR (M20)

R SYS D - PUMP (M21)

(2) On pilots overhead circuit breaker panel CB1, zone 215, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, open and tag circuit breaker GROUND SERVICE - MLG GND SENSE (L8).

(3) On pilots overhead PFCS panel, release (out) the following switchlights:

RUDDER

STABILIZER A, B, C, D

AILERON L OUTBD, L INBD, R OUTBD, R INBD

SPOILER L5&6, L&R4, L&R1, L&R2, L&R3, R5&6

(4) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREA.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Using AC pumps, turn on hydraulic systems B and C pressure (Ref. 29-11-00). Pressure gages must indicate 3000 psi minimum.

(6) Depress (latch in) switchlights turned off in Step 4A(3).

(7) On pilots center console, position ROLL and YAW trim to neutral and PITCH to 4 degrees. Verify positions by observing surface position indicator on pilots main instrument panel.

(8) Turn on C hydraulic system (C2) ATM (Ref. 29-11-00).

(9) Using flap control handle, position flaps to 4-degree position (slats will fully extend). Verify flap position on flap position indicator (pilots center instrument panel) and slat position on SLAT MONITOR panel (Flight Engineer/Second Officers upper instrument panel).

(10) Turn off hydraulic systems B and C pressure (Ref. 29-11-00).

(11) Verify all pilots overhead PFCS panel flight control switchlights are depressed (latched in).

(12) Verify YAW SAS 1 and 2 and DLC/AUTO SPLR 1 and 2 switchlights are depressed (latched in).

(13) Verify speedbrake handle manual override indicator lights are off.

B. Hydraulic System B

(1) Observe cautions called out in Para. 4A.

(2) Using AC pump, turn on hydraulic system B pressure (Ref. 29-11-00).

(3) Note pressure indicated on Flight Engineer/Second Officers HYDRAULIC SYSTEM panel. Minimum acceptable pressure is 2500 psi.

(4) Turn off hydraulic system B pressure (Ref. 29-11-00).

C. Hydraulic System C

(1) Observe cautions called out after Step 4A(4).

(2) Using AC pump, turn on hydraulic system C pressure (Ref. 29-11-00).

(3) Note pressure indicated on Flight Engineer/Second Officers HYDRAULIC SYSTEM panel. Minimum acceptable pressure is 2500 psi.

(4) Turn off hydraulic system C pressure (Ref. 29-11-00).

D. Hydraulic System A

(1) On Flight Engineer/Second Officers circuit breaker panel CB2, open and tag the following circuit breakers: RUDDER SERVO A (K12), DLC SERVO B (H15) and AILERON SERVO A L (J20).

(2) On pilots overhead PFCS panel, release (out) the following switchlights: RUDDER, STABILIZER B, AILERON L OUTBD, L INBD, R INBD, R OUTBD, SPOILER L5&6, L&R4, L&R1, and R5&6.

(3) Observe cautions called out after Step 4A(4).

(4) Using AC pump, turn on hydraulic system B pressure (Ref. 29-11-00).

(5) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel depress (latch in) PTU B-A.

(6) Note pressure indicated. Minimum acceptable pressure is 1750 psi.

(7) Release (out) PTU B-A.

(8) Turn off hydraulic system B pressure (Ref. 29-11-00).

(9) Remove tags and close circuit breakers opened in Step 4D(1).

(10) Depress (latch in) switchlights turned off in Step 4D(2).

E. Hydraulic System D

(1) On Flight Engineer/Second Officers circuit breaker panel CB2, open and tag circuit breakers AILERON SERVO B INBD & OUTBD L&R (J21), AILERON SERVO D INBD & OUTBD R (J22) and DLC SERVO B (H15).

(2) On pilots overhead PFCS panel, release (out) the following switchlights: RUDDER, STABILIZER C, SPOILER L&R3, L&R4, L&R1, R5&6, L5&6, and AILERON L INBD, R INBD.

(3) Observe precautions called out after Step 4A(4).

(4) Verify STABILIZER B switchlight is depressed (latched in), and pressurize B system using AC pump.

(5) Turn on C hydraulic system (C2) ATM (Ref. 29-11-00).

(6) Operate flaps to the 0-degree position.

(7) Turn off C hydraulic system (C2) ATM (Ref. 29-11-00).

(8) Using AC pump, turn on hydraulic system C pressure (Ref. 29-11-00).

(9) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, depress (latch in) PTU C-D.

(10) Note pressure indicated. Minimum acceptable pressure is 2050 psi.

(11) Release (out) PTU C-D.

(12) Turn off hydraulic system B and C pressure (Ref. 29-11-00).

(13) Remove tags and close circuit breakers opened in Step 4E(1).

(14) Depress (latch in) switchlights turned off in Step 4E(2).

F. Completion

(1) Turn off electrical power (Ref. 24-41-00).

5. Detailed Internal Leakage Check

A detailed internal leakage check is used to identify faulty components when gross internal leakage is beyond limits.

A. Preparation

(1) Connect hydraulic ground power unit to applicable system with flow monitoring equipment in pressure or return line, as required by type of flowmeter (Ref. 29-11-00).

(2) Turn on electrical power (Ref. 24-41-00).

(3) Establish communication between flight station and quiescent flow measuring equipment.

(4) Verify all circuit breakers called out in Step 4A(1) are closed.

(5) Open and tag all circuit breakers called out in Step 4A(2).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

RAM AIR TURBINE SAFETY BAR INSTALLED.

(6) Pressurize applicable system to 3000 psi and verify reservoir fluid level is in operating range and reservoir air bleed check has been accomplished (Ref. 12-13-01).

(7) Proceed to applicable Paragraph 5B through 5E for hydraulic system to be tested as follows:

Paragraph 5B - System A

Paragraph 5C - System B

Paragraph 5D - System C

Paragraph 5E - System D

B. Hydraulic System A

(1) Verify preparation procedures specified in Paragraph 5A have been accomplished and system A is pressurized.

(2) On PFCS panel on pilots overhead panel, zone 215, verify following switchlights are depressed (latched in):

(a) RUDDER

(b) STABILIZER A

(c) AILERON L OUTBD, L INBD

(d) SPOILER L&R 2

(3) On FCES panel, verify following switchlights are depressed (latched in):

(a) YAW SAS 2

(b) DLC/AUTO SPLR 2

(4) Fully retard throttles to idle.

(5) Verify lights on speed brake lever are off (DLC servo operative).

(6) Operate flaps to 4-degree position.

(7) Verify the following conditions:

(a) Left inboard and outboard ailerons operative.

(b) Rudder in 0-degree trim position.

(c) Stabilizer at 4-degree trim position.

(d) Flaps in 4-degree position.

(e) System A pressure 3000 psi and maintained for duration of test.

(8) Note flowmeter reading and record as test flow 1 and as leakage 1A (Ref. Fig. 602).

(a) Leakage 1A is system A gross internal leakage.

(b) If leakage is less than 7.0 gpm, no further check is necessary.

(c) If leakage is greater than 7.0 gpm, proceed to Step 5B (9).

NOTE: To accomplish the remaining steps, hydraulic system C must be pressurized and STABILIZER C switchlight on PFCS panel depressed. The configuration of other C system components is optional. The AC pump may be used for this purpose.

(9) Shut down all system A components listed in Fig. 602 (Items 2 through 11).

(a) Note flowmeter reading; record as test flow 1X and leakage 1AX. (Leakage 1AX is the gross internal leakage for system A with servos off).

(b) If leakage 1AX is less than 1.0 gpm, proceed to Step 5B (10).

WARNING: IF SYSTEM HAS BEEN OPERATING FOR SOME TIME AND AMBIENT TEMPERATURES ARE HIGH, SYSTEM PLUMBING TEMPERATURE MAY BE TOO HIGH FOR PERSONAL CONTACT.

(c) If leakage is greater than 1.0 gpm, check for indication of component internal flows by feeling hydraulid lines. If component has excessive internal flow, return line adjacent to component will have higher temperature than pressure line.

NOTE: Releasing (out) SPOILER L&R2 switchlight does not shut off all hydraulic flow to the No. 2 left spoiler. An internally leaking spoiler servo can be confirmed by noting the spoiler panel slowly rises after hydraulic power is turned off.

(10) Reactivate all system A components as outlined in Steps 5B(2) through 5B(7).

(11) Shut down each system component (Items 2 through 11) individually and in step sequence as listed in Fig. 602. Note and record test flows and component leakage in accordance with either method 1 or method 2 as follows:

(a) Method 1,
after each component is shutdown, note and record test flow. Subtract test flow from system test flow 1 (see example) and record as component leakage. Reactivate component.

Example:

If system test flow 1 is 7.90 gpm and test flow 7 is 7.45 gpm, leakage 7A is 0.45 gpm; this is the leakage for the rudder servo.

(b) Method 2,
after each component is shutdown, note and record test flow. Subtract test flow 2 from test flow 1 and each subsequent test flow from the preceding test flow (see example) and record as component leakage. Do not reactivate components shut down until instructed to do so in Step 5B(12).

Example:

If test flow 6 is 4.05 gpm and test flow 7 is 3.60 gpm, leakage 7A is 0.45 gpm; this is the leakage for the rudder servo.

(12) Reactivate all system A components as outlined in Steps 5B(2) through 5B(7).

C. Hydraulic System B

(1) Verify preparation procedures specified in Paragraph 5A have been accomplished and system B is pressurized.

(2) On PFCS panel on pilots overhead panel, zone 215, verify following switchlights are depressed (latched in).

(a) RUDDER

(b) STABILIZER B

(c) AILERON L OUTBD, L INBD, R INBD, R OUTBD

(d) SPOILER L5&6, L&R4, L&R1, R5&6

(3) On FCES panel, verify following switchlights are depressed.

(a) YAW SAS 1

(b) DLC/AUTO SPLR 1

(4) Fully retard throttles to idle.

(5) Verify lights on SPEED BRAKE handle are off (DLC servo operative).

(6) Operate flaps to 4-degree position (requires system A or system C hydraulic pressure).

(7) With BRAKE SYSTEM SELECTOR switch, select NORMAL (system B) and verify parking brake is OFF.

(8) Verify following conditions:

(a) All ailerons in 0-degree trim position.

(b) Rudder in 0-degree trim position.

(c) Stabilizer at 4-degree trim position.

(d) Flaps at 4-degree position.

(e) System B pressure is 3000 psi and is maintained for duration of test.

(9) Note flowmeter reading and record as test flow 1 and leakage 1B (Ref. Fig. 603).

(a) Leakage 1B is gross leakage flow for system B.

(b) If leakage is less than 7.0 gpm, no further check of system B is necessary.

(c) If leakage is greater than 7.0 gpm proceed to Step 5C (10).

NOTE: To accomplish remaining steps, hydraulic system C must be pressurized and STABILIZER C switchlight on PFCS panel depressed. The configuration of other C system components is optional. The AC pump may be used for this purpose.

(10) Shut down all system B components listed in Fig. 603 (Items 2 through 15).

(a) Note flowmeter reading; record as test flow 1X and leakage 1BX. (Leakage 1BX is the gross internal leakage for system B with servos off)

(b) If leakage 1BX is less than 1.0 gpm, proceed to Step 5C (11)

WARNING: IF SYSTEM HAS BEEN OPERATING FOR SOME TIME AND AMBIENT TEMPERATURES ARE HIGH, SYSTEM PLUMBING TEMPERATURE MAY BE TOO HIGH FOR PERSONAL CONTACT.

(c) If leakage is greater than 1.0 gpm, check for indication of component internal flows by feeling hydraulid lines. If component has excessive internal flow, return line adjacent to component will have higher temperature than pressure line.

NOTE: Releasing (out) SPOILER L5&6, L&R4, and R5&6 switch lights does not shut off all hydraulic flow to these spoilers. An internally leaking spoiler servo can be confirmed by noting the spoiler panel slowly rises when hydraulic power is turned off.

(11) Reactivate all system B components as outlined in Steps 5C(2) through 5C (8).

(12) Shut down each system component (Items 2 through 15) individually and in step sequence as listed in Fig.

603. Note and record test flows and component leakage in accordance with either method 1 or method 2 as follows:

(a) Method 1,
after each component is shutdown, note and record test flow. Subtract test flow from system test flow 1 (see example) and record as component leakage. Reactivate component.

Example:

If system test flow 1 is 7.90 gpm and test flow 12 is 7.45 gpm, leakage 12B is 0.45 gpm; this is the leakage for the rudder servo.

(b) Method 2,
after each component is shutdown, note and record test flow. Subtract test flow 2 from test flow 1 and each subsequent test flow from the preceding test flow (see example) and record as component leakage. Do not reactivate components shut down until instructed to do so in Step 5C(13).

Example:

If test flow 11 is 4.05 gpm and test flow 12 is 3.60 gpm, leakage 12B is 0.45 gpm; this is the leakage for the rudder servo.

(13) Reactivate all System B components as outlined in Steps 5C(2) through 5C(8).

D. Hydraulic System C

Internal leakages of components within the landing gear system are primarily due to lap seal and valve seat leakages. Any significant increase in internal leakage dictates that corrective action should be taken.

The left and right MLG S.O.V.'s are used during internal leakage checks to isolate all landing gear components downstream of the valves. The S.O.V.'s internal leakage is unaffected by being "off" or "on". Therefore detected leakage must be a phase control valve or door control valve, etc.

NOTE: Leakage rates of approximately 0.24 gpm are sufficiently high to be audible and may be of assistance in isolating the component at fault.

The internal leakage of landing gear control module is checked with landing gear lever in neutral. The components involved are left and right MLG S.O.V.'s, NLG S.O.V., landing gear alternate by-pass valve and cartridge seals for the landing gear control valve.

(1) Verify preparation procedures specified in Paragraph 5A have been accomplished and system C is pressurized.

(2) On PFCS panel on pilots overhead panel, zone 215, verify following switchlights are depressed (OFF light out):

(a) RUDDER

(b) STABILIZER C

(c) AILERON L INBD and R INBD

(d) SPOILER L5&6, L&R3, R5&6

(3) Place brake system selector switch in ALTERNATE C SYSTEM and verify parking brake is OFF.

(4) Place LANDING GEAR selector in DOWN position.

(5) Operate flaps to 4-degree position.

(6) Verify the following conditions:

(a) Left and right inboard ailerons in 0-degree trim position.

(b) Rudder in 0-degree trim position.

(c) Stabilizer at 4-degree trim position.

(d) Flaps at 4-degree position.

(e) System C pressure is 3000 psi and is maintained for duration of test.

(7) Note flowmeter reading and record as test flow 1 and leakage 1C (Ref. Fig. 604).

(a) Leakage 1C is gross leakage for system C.

(b) If leakage is less than 7.0 gpm, no further check of system C is necessary.

(c) If leakage is greater than 7.0 gpm, proceed to Step 5D (8).

NOTE: To accomplish remaining steps, hydraulic system B must be pressurized and STABILIZER switchlight on PFCS panel depressed (latched in). The configuration of other B system components is optional. The AC pump may be used for this purpose.

(8) Shut down all system C components listed in Fig. 604 (Items 2 through 13).

(a) Note flowmeter reading; record as test flow 1X and leakage 1CX. (Leakage 1CX is the gross internal leakage for system C with servos off and gear valves closed.)

(b) If leakage 1CX is less than 0.5 gpm, proceed to Step 5D (9)

WARNING: IF SYSTEM HAS BEEN OPERATING FOR SOME TIME AND AMBIENT TEMPERATURES ARE HIGH, SYSTEM PLUMBING TEMPERATURE MAY BE TOO HIGH FOR PERSONAL CONTACT.

(c) If leakage is greater than 0.5 gpm, check for indication of component internal flows by feeling hydraulic lines. If component has excessive internal flow, return line adjacent to component will have higher temperature than pressure line.

NOTE: Shutting down SPOILER L5&6, L&R3, and R5&6 does not shut off all hydraulic flow to these spoilers. An internally leaking spoiler servo can be confirmed by noting that the spoiler panel slowly rises when hydraulic power is turned off.

(9) Reactivate all system C components as outlined in Steps 5D(2) through 5D(6).

R (10) Shut down each system component (Items 2 through 13) R individually and in step sequence as listed on Fig. R 604. Note and record test flows and component leakage R in accordance with either method 1 or method 2 as R follows:

R (a) Method 1,
R after each component is shutdown, note and record R test flow. Subtract test flow from system test R flow 1 (see example) and record as component R leakage. Reactivate component.

R Example:

R If system test flow 1 is 7.90 gpm and test
R flow 8 is 7.45 gpm, leakage 8C is 0.45 gpm;
R this is the leakage for the rudder servo.

R (b) Method 2,
R after each component is shutdown, note and record
R test flow. Subtract test flow 2 from test flow 1
R and each subsequent test flow from the preceding
R test flow (see example) and record as component
R leakage. Do not reactivate components shut down
R until instructed to do so in Step 5D(11).

R Example:

R If test flow 7 is 4.05 gpm and test flow 8 is
R 3.60 gpm, leakage 8C is 0.45 gpm; this is the
R leakage for the rudder servo.

R (11) Reactivate all System C components as outlined in Step 5D(2) through 5D(6).

E. Hydraulic System D

(1) Verify preparation procedures specified in Paragraph 5A have been accomplished.

(2) Verify system D is pressurized.

(3) On PFCS panel on pilots overhead panel, zone 215, verify following switchlights are depressed (latched in):

(a) STABILIZER D

(b) AILERON R INBD and R OUTBD

(c) SPOILER L&R2

(4) Verify the following conditions:

(a) Right inboard and right outboard ailerons operative.

(b) Stabilizer at 4-degree position.

(c) System D pressure is 3000 psi and is maintained for duration of test.

(5) Note flowmeter reading and record as test flow 1 and leakage 1D (Ref. Fig. 605).

(a) Leakage 1D is gross leakage for system D.

(b) If leakage is less than 5.5 gpm, no further check of system D is necessary.

(c) If leakage is greater than 5.5 gpm, proceed to Step 5E(6).

NOTE: To accomplish remaining steps, hydraulic system B must be pressurized and STABILIZER B switchlight on PFCS panel depressed. Configuration of other B system components is optional. The AC pump may be used for this purpose.

(6) Shut down all system D components listed in Fig. 605 (Items 2 through 5).

(a) Note flowmeter reading; record as test flow 1X and leakage 1DX. (Leakage 1DX is the gross internal leakage for system D with servos off).

(b) If leakage 1DX is less than 0.5 gpm, proceed to Step 5E(7).

WARNING: IF SYSTEM HAS BEEN OPERATING FOR SOME TIME AND AMBIENT TEMPERATURES ARE HIGH, SYSTEM PLUMBING TEMPERATURE MAY BE TOO HIGH FOR PERSONAL CONTACT.

(c) If leakage is greater than 0.5 gpm, check for indication of component internal flows by feeling hydraulic lines. If component has excessive internal flow, return line adjacent to component will have higher temperature than pressure line.

NOTE: Shutting down SPOILER L&R2 does not shut off all hydraulic flow to the No. 2 spoiler. An internally leaking spoiler servo can be confirmed by noting that spoiler panel slowly rises when hydraulic power is turned off.

(7) Reactivate all system D components as outlined in Steps 5E(3) and 5E(4).

R (8) Shut down each system component (Items 2 through 5)
R individually and in step sequence as listed in Fig.
R 605. Note and record test flows and component leakage
R in accordance with either method 1 or method 2 as
R follows:

R (a) Method 1,
R after each component is shutdown, note and record

R test flow. Subtract test flow from system test
R flow 1 (see example) and record as component
R leakage. Reactivate component.

R Example:

R If system test flow 1 is 6.10 gpm and test
R flow 2 is 4.30 gpm, leakage 2D is 1.80 gpm;
R this is the leakage for the stabilizer servo.

R (b) Method 2,
R after each component is shutdown, note and record
R test flow. Subtract test flow 2 from test flow 1
R and each subsequent test flow from the preceding
R test flow (see example) and record as component
R leakage. Do not reactivate components shut down
R until instructed to do so in Step 5E(9).

R Example:

R If test flow 3 is 1.10 gpm and test flow 4 is
R 0.30 gpm, leakage 4D is 0.80 gpm; this is the
R leakage for the right inboard aileron servo.

R (9) Reactivate all System D components as outlined in Steps 5E(3) and 5E(4).

F. Completion

(1) Turn off hydraulic system pressure (Ref. 29-11-00).

(2) Turn off electrical power (Ref. 24-41-00).

AIRCRAFT:	STATION:
HYDRAULIC FLUID TEMPERATURE	AT START OF TEST:
	AT END OF TEST:

STEP	CONTROLS		SYSTEM/SUBSYSTEM COMPONENT	TEST FLOW (GPM)		LEAKAGE (GPM)		
	LOCATION	POSITION				COMPONENT LEAKAGE		MAX ALLOW
1	SEE BELOW	ALL SERVOS ON	SYSTEM A GROSS LEAKAGE - SERVOS ON	1		1A		7.00
1X		ALL SERVOS OFF	SYSTEM A GROSS LEAKAGE - SERVOS OFF	1X		1AX		1.00
2	PFCS PANEL	STABILIZER A - OFF	STABILIZER SERVO	2		2A		2.50
3	PFCS PANEL	AILERON L OUTBD - OFF	L OUTBD AILERON SERVO	3		3A		0.80
4	NOT USED							
5	PFCS PANEL	SPOILER L&R NO. 2 - OFF	SPOILER NO. 2 SERVO	5		5A		0.32
6	FCES PANEL	YAW SAS 2 - OFF	YAW SAS PORTION OF RUDDER SERVO	6		6A		0.54
7	PFCS PANEL	RUDDER - OFF	RUDDER SERVO	7		7A		1.09
8	PFCS PANEL	AILERON L INBD - OFF	LEFT INBD AILERON SERVO	8		8A		1.09
9	FCES PANEL	DLC/SPOILER NO. 2 - OFF	DLC SERVO AUTO MODE CHANNEL	9		9A		0.70
10	SPEED BRAKE LEVER	DEPRESS LEVER SWITCH (LIGHT ON)	DLC SERVO MANUAL MODE CHANNEL	10		10A		0.60
11	FLAP CONTROL HANDLE	FLAP CONTROL TO 0^{0}	FLAP PDU	11		11A		0.40

TEST ACCOMPLISHED BY:	DATE:

M1-0000-29-863

Hydraulic System A Internal Leakage Check
Figure 602

AIRCRAFT:		STATION:					
HYDRAULIC FLUID TEMPERATURE		AT START OF TEST:					
		AT END OF TEST:					
	CONTROLS			TEST FLOW (GPM)		LEAKAGE (GPM)	
STEP	LOCATION	POSITION	SYSTEM/SUBSYSTEM COMPONENT			COMPONENT LEAKAGE	MAX. ALLOW.
1	SEE BELOW	ALL SERVOS ON	SYSTEM B GROSS LEAKAGE - SERVOS ON	1		1B	7.00
1X		ALL SERVOS OFF	SYSTEM B GROSS LEAKAGE - SERVOS OFF	1X		1BX	1.00
2	PFCS PANEL	STABILIZER B - OFF	STABILIZER SERVO	2		2B	2.50
3	PFCS PANEL	AILERON L OUTBD - OFF	LEFT OUTBD AILERON SERVO	3		3B	0.80
4	NOT USED						
5	PFCS PANEL	AILERON R OUTBD - OFF	RIGHT OUTBD AILERON SERVO	5		5B	0.80
6	PFCS PANEL	AILERON R INBD - OFF	RIGHT INBD AILERON SERVO	6		6B	1.09
7	PFCS PANEL	SPOILER L 5 & 6 OFF	LEFT NO. 6 SPOILER SERVO	7		7B	0.32
8	PFCS PANEL	SPOILER L&R 4 - OFF	LEFT & RIGHT NO. 4 SPOILER SERVO	8		8B	0.64
9	PFCS PANEL	SPOILER L&R 1 - OFF	LEFT & RIGHT NO. 1 SPOILER SERVO	9		9B	0.64
10	PFCS PANEL	SPOILER R 5 & 6 - OFF	RIGHT NO. 6 SPOILER SERVO	10		10B	0.32
11	PFCS PANEL	YAW SAS 1 - OFF	YAW SAS PORTION OF RUDDER SERVO	11		11B	0.54
12	PFCS PANEL	RUDDER - OFF	RUDDER SERVO	12		12B	1.09
13	PFCS PANEL	AILERON L INBD - OFF	LEFT INBD AILERON SERVO	13		13B	1.09
14	FCES PANEL	DLC/AUTO SPLR 1 - OFF	DLC SERVO AUTO MODE CHANNEL	14		14B	0.70
15	SPEED BRAKE LEVER	DEPRESS SWITCH - (LEVER LIGHT COMES ON)	DLC SERVO MANUAL MODE CHANNEL	15		15B	0.60
TEST ACCOMPLISHED BY:					DATE:		

M1-0000-29-864

Hydraulic System B Internal Leakage Check
Figure 603

AIRCRAFT:		STATION:						
HYDRAULIC FLUID TEMPERATURE		AT START OF TEST:						
		AT END OF TEST:						
STEP	CONTROLS		SYSTEM/SUBSYSTEM COMPONENT	TEST FLOW (GPM)		LEAKAGE (GPM)		
	LOCATION	POSITION				COMPONENT LEAKAGE		MAX. ALLOW.
1	SEE BELOW	ALL SERVOS ON (LG VALVES OPEN)	SYSTEM C GROSS LEAKAGE - SERVOS ON	1		1C		7.00
1X		ALL SERVOS OFF (LG VALVES CLOSED)	SYSTEM C GROSS LEAKAGE - SERVOS OFF	1X		1CX		0.50
2	PFCS PANEL	STABILIZER C - OFF	STABILIZER SERVO	2		2C		2.50
3	PFCS PANEL	AILERON L INBD - OFF	LEFT INBD AILERON SERVO	3		3C		1.09
4	PFCS PANEL	AILERON R INBD - OFF	RIGHT INBD AILERON SERVO	4		4C		1.09
5	PFCS PANEL	SPOILER L 5 & 6 - OFF	LEFT NO. 5 SPOILER SERVO	5		5C		0.32
6	PFCS PANEL	SPOILER L&R 3 - OFF	LEFT & RIGHT NO. 3 SPOILER SERVO	6		6C		0.64
7	PFCS PANEL	SPOILER R 5 & 6 - OFF	RIGHT NO. 5 SPOILER SERVO	7		7C		0.32
8	PFCS PANEL	RUDDER - OFF	RUDDER SERVO	8		8C		1.09
9	FLAP HANDLE	POSITION FLAPS TO 0°	FLAP PDU	9		9C		0.40
10 ⚠1	LG CONT MOD HYD SVCE CTR	NOSE LG MAN. SHUT-OFF VALVE - CLOSED	NOSE LG & NOSE WHEEL STEERING	10		10C		0.20
11 ⚠1	LG CONT MOD HYD SVCE CTR	LEFT MLG MAN. SHUT-OFF VALVE - CLOSED	LEFT MAIN GEAR	11		11C		0.09
12 ⚠1	LG CONT MOD HYD SVCE CTR	RTMLG MAN. SHUT-OFF VALVE - CLOSED	RIGHT MAIN GEAR	12		12C		0.09
13	LG CONT LEVER FLT STATION	LG CONT LEVER - POSITION TO NEUTRAL	LANDING GEAR CONTROL MODULE	13		13C		0.05
TEST ACCOMPLISHED BY:						DATE:		

⚠1 CAUTION: L.G. MANUAL SHUT-OFF VALVES WILL NOT PREVENT RETRACTION OF THE NOSE L.G. OR PARTIAL OPENING OF THE M.L.G. DOORS. TAKE PRECAUTIONS TO ASSURE "UP" PRESSURE IS NOT APPLIED. VALVES ARE IN THE "DOWN" PRESSURE SECTION OF THE MODULE.

M1-0000-29-217

C C Hydraulic System C Internal Leakage Check
Figure 604

R R 001B EFFECTIVITY: ALL

AIRCRAFT:		STATION:						
HYDRAULIC FLUID TEMPERATURE		AT START OF TEST:						
		AT END OF TEST:						
STEP	CONTROLS		SYSTEM/SUBSYSTEM COMPONENT	TEST FLOW (GPM)		LEAKAGE (GPM)		
	LOCATION	POSITION				COMPONENT LEAKAGE		MAX. ALLOW.
1	SEE BELOW	ALL SERVOS ON	SYSTEM D GROSS LEAKAGE - SERVOS ON	1		1D		5.50
1X		ALL SERVOS OFF	SYSTEM D GROSS LEAKAGE - SERVOS OFF	1X		1DX		3.50
2	PFCS PANEL	STABILIZER D - OFF	STABILIZER SERVO	2		2D		2.50
3	PFCS PANEL	AILERON R OUTBD - OFF	R OUTBD AILERON SERVO	3		3D		0.80
4	PFCS PANEL	AILERON R INBD - OFF	R INBD AILERON SERVO	4		4D		1.09
5	PFCS PANEL	SPOILER L&R 2 - OFF	RIGHT NO. 2 SPOILER SERVO	5		5D		0.32
TEST ACCOMPLISHED BY:					DATE:			

M1-0000-29-856

Hydraulic System D Internal Leakage Check
Figure 605

. C 6. Deleted

7. Intersystem Leakage Check

A. General

Intersystem leakage is the transfer of hydraulic fluid from one system to another. The four hydraulic systems have completely separate fluid supplies. If one system tends to gain fluid, while another system loses fluid, intersystem leakage may be the cause.

B. Intersystem Leakage Path

(1) Power control servo valves

Leakage may occur between the following systems:

A to B and C

B to A, C and D

C to A, B and D

D to B and C

Leakage occurs via lap lakage paths. With all systems pressurized, intersystem leakage should be negligible since return pressure of all systems is approximately 85 psi. Lap leakages are proportional to the difference in return pressure between systems. This leakage will usually only occur when one or more systems are shut off and return pressure of that system is zero.

(a) System Pressure Differentials

Accumulators will maintain pressure within each system for up to several days following the removal of a pressure source.

Pressure in the accumulators bleeds off slowly through reservoir priority valves, the manual depressurization valve and the reservoir pressurization piston. The rate of decay for each system will be different, but normally, pressure differences will be small. The resulting fluid transfer will also be small.

Potential causes of large pressure differences are:

- Higher than normal leakage in a priority valve, a depressurization valve or a reservoir piston (receiving system).

- Maintenance activity requiring depressurization of a system at a time when other systems are still pressurized (receiving system).

- Lower than normal leakage in a priority valve, a depressurization valve or a reservoir piston (losing system).

- Maintenance activity requiring pressurization of one system, even for a short time, when other systems have lost pressure (losing system). B and C systems are sometimes pressurized to power brakes; this will result in leakage from B to A or C to D.

(b) Pressure differential checks

With all servos within leakage specifications it is possible for an unacceptably high amount of intersystem leakage to occur.

The following procedure is recommended before attempting to measure leakage at individual servos.

- Determine if there are maintenance procedures in effect that will result in long time return pressure differentials between systems.

- Check reservoir pressurization system by recording reservoir pressure at approximately one hour intervals.

- If a significant difference in the pressure decay rate is found, check for leakage at priority valves, reservoir depressurization valve or reservoir internal seal.

(c) Servo Valves

The servo valves where a majority of intersystem leakage occurs are the:

Inboard Aileron and Rudder Servos

One end of the triple parallel servo valves in these servos has a return pressure lap leakage path to its common linkage cavity. The rudder and the left inboard aileron servos also contain dual autopilot servo modules, which have an additional lap leakage path, to its common cavity through modulating pistons and their couplers.

Outboard Aileron Servos

These servos employ a dual-tandem power control servo valve. At the mid-section and the ends of each tandem valve there are lap leakage paths from each half's return pressure to the common linkage cavity.

Stabilizer Servos

These servos employ a dual-tandem power control servo valve. Return to common cavity lap leakage paths exist at both ends of the valve. A return pressure to return pressure lap leakage path exists at the mid section of the valve.

Direct lift and Speedbrake (DLC)

This servo utilizes a dual-tandem power control servo valve. At its mid-section there is a return to return lap leakage path. Other lap leakages in this servo are to non-common cavities and do not contribute to the intersystem leakage.

Table 602 lists the hydraulic systems that operate each servo.

Servo Hydraulic System Connections
Table 602

Servo	Hydraulic System
Rudder	A B C
LH Inboard Aileron	A B C
RH Inboard Aileron	B C D
LH Outboard Aileron	A B
RH Outboard Aileron	B D
LH Stabilizer	A B

Servo Hydraulic System Connections (Cont)
Table 602

Servo	Hydraulic System
RH Stabilizer	C D
Direct Lift Control	A B
Pitch Auto Pilot	A B

(2) Brake Intersystem Leakage

Some intersystem transfer of fluid will occur at the moment of shuttling of the 8 brake system shuttle valves. The maximum allowable transfer is 3cc per valve.

Failure of a shuttle valve may cause intersystem leakage. This leakage would occur when pressure is applied through the shuttle valves to the brake.

C. Fault identification

Intersystem leakage is usually detected by noting an increase in reservior quantity in one system and a corresponding reduction in reservior quantity in another.

A false identification of intersystem leakage is given when a low pressure indicator light on the FE/SO HYDRAULIC SYSTEM PANEL, zone 215, goes out when another hydraulic system is activated. This may be caused by a faulty pressure switch.

(1) Intersystem leakage in brake shuttle valves is usually indicated by:

(a) Leakage through the brake shuttle valves is always from system B to C or system C to B.

(b) Four hour parking brake duration cannot be attained.

NOTE: When starting parking brake operation at a brake pressure of 2700 psi, brake pressure must be 2000 psi or greater after two hours. The pressure decay rate below 2000 psi must not exceed 115 psi per hour.

(c) Brake control module hydraulic fuse indicator is tripped (popped out) during parking brake operation.

(d) A temperature differential is detected between alternate and normal brake lines to the shuttle valve.

(e) Unusual noises coming from a shuttle valve.

D. Intersystem Leakage Rate

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRUALIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

PITCH TRIM WHEEL AT ZERO DEGREES.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

Turn on electrical system (Ref. 24-41-00) Table 603 lists the maximum intersystem leakage rates permitted.

Servo Module Leakage Rates
Table 603

ALLOWABLE INTERSYSTEM LEAKAGE RATES CC per Minute Maximum					
Servo	A to B B to A	A to C C to A	B to C C to B	B to D D to B	C to D D to C
Rudder	1.3	0.5	0.5		
LH Inboard Aileron	1.3	0.5	0.5		
RH Inboard Aileron			0.5	0.5	0.5
LH Outboard Aileron	0.5				
RH Outboard Aileron				0.5	
LH Stabilizer	2.5				
RH Stabilizer					2.5
Direct Lift Control	.3				

Servo Module Leakage Rates (Cont)
Table 603

Servo	ALLOWABLE INTERSYSTEM LEAKAGE RATES CC per Minute Maximum				
	A to B B to A	A to C C to A	B to C C to B	B to D D to B	C to D D to C
Pitch Auto Pilot	1.5				

NOTE: Before any of the following checks are made, insure communications are established between the servo area and flight station or the hydraulic service center.

(1) Rudder

(a) On FE/SO overhead circuit breaker panel CB2, close RUDDER SERVO circuit breakers (K12, K13, K14).

(b) Open access doors 324AL and 324AR (Ref. Fig. 606 and 6-40-00).

(c) Disconnect return line of the system that is gaining fluid and cap return line. Prepare to catch fluid from servo in a small container.

(d) Pressurize hydraulic system that is losing fluid. (Ref. 29-11-00).

(e) If flow is within limits, remove hydraulic system pressure (Ref. 29-11-00), reconnect return line and close access doors.

(2) Inboard Aileron

(a) On FE/SO Overhead circuit breaker panel CB2 close, for left wing, AILERON SERVO A, B, and C (J19, J20, J21), for right wing AILERON SERVO B, C, and D (J19, J20, J22)

(b) Remove pylon fairing and open following inboard aileron servo access panels:

For left wing lower surface - pylon fairing 453H, access panel 551BB.

For left wing upper surface - access panel 551AT

For right wing lower surface - pylon fairing 463H, access panel 651BB

For right wing upper surface - access panel 651AT (Ref. Fig. 607 and 6-40-00)

(c) Disconnect return line of system that is gaining fluid and cap return line. Prepare to catch fluid from servo in a small container.

(d) Pressurize hydraulic system that is losing fluid. (Ref. 29-11-00).

(e) If flow is within limits, remove hydraulic system pressure (Ref. 29-11-00), reconnect return line and close access doors.

(3) Outboard Ailerons

(a) On FE/SO Overhead circuit breaker panel CB2 close, for right wing, AILERON SERVO A and B (J20, J21); for right wing, AILERON SERVO B and D (J21, J22).

(b) Open the following outboard aileron servo access panels:

For left wing upper surface - 571AT

For left wing lower surface - 571CB

For right wing upper surface - 671AT

For right wing lower surface - 671CB

(Ref. Fig. 608 and 6-40-00)

(c) Disconnect return line of system that is gaining fluid and cap return line. Prepare to catch fluid from the servo in a small container.

(d) Pressurize hydraulic system that is losing fluid. (Ref. 29-11-00).

(e) If flow is within limits, remove hydraulic system pressure (Ref. 29-11-00), reconnect return line and close access doors.

(4) Horizontal Stabilizer

(a) On FE/SO Overhead circuit breaker panel CB2 close STABILIZER SERVO LB (H16), RC (H17), LA (H18), and RD (H19).

(b) Open following access panels: For left servo - 316BB, 317AB (Ref. Fig. 609 and 6-40-00).

(c) Disconnect return line of system that is gaining fluid and cap return line. Prepare to catch fluid from servo in a small container.

(d) Pressurize hydraulic system that is losing fluid. (Ref. 29-11-00).

(e) If flow is within limits, remove hydraulic system pressure, (Ref. 29-11-00), reconnect return line and close access doors.

(5) Direct Lift Control (DLC)

(a) On FE/SO Overhead circuit breaker panel CB2 Close DLC SERVO A or B and FLIGHT STATION MISC - R AOA.

(b) Open hydraulic service center door 147 AB.

(c) Disconnect return line of system that is gaining fluid and cap return line. Prepare to catch fluid from servo in a small container. (Ref. Fig. 610).

(d) Pressurize system that is losing fluid. (Ref. 29-11-00).

(e) If flow is within limits, remove hydraulic system pressure, (Ref. 29-11-00), reconnect return line and close access door.

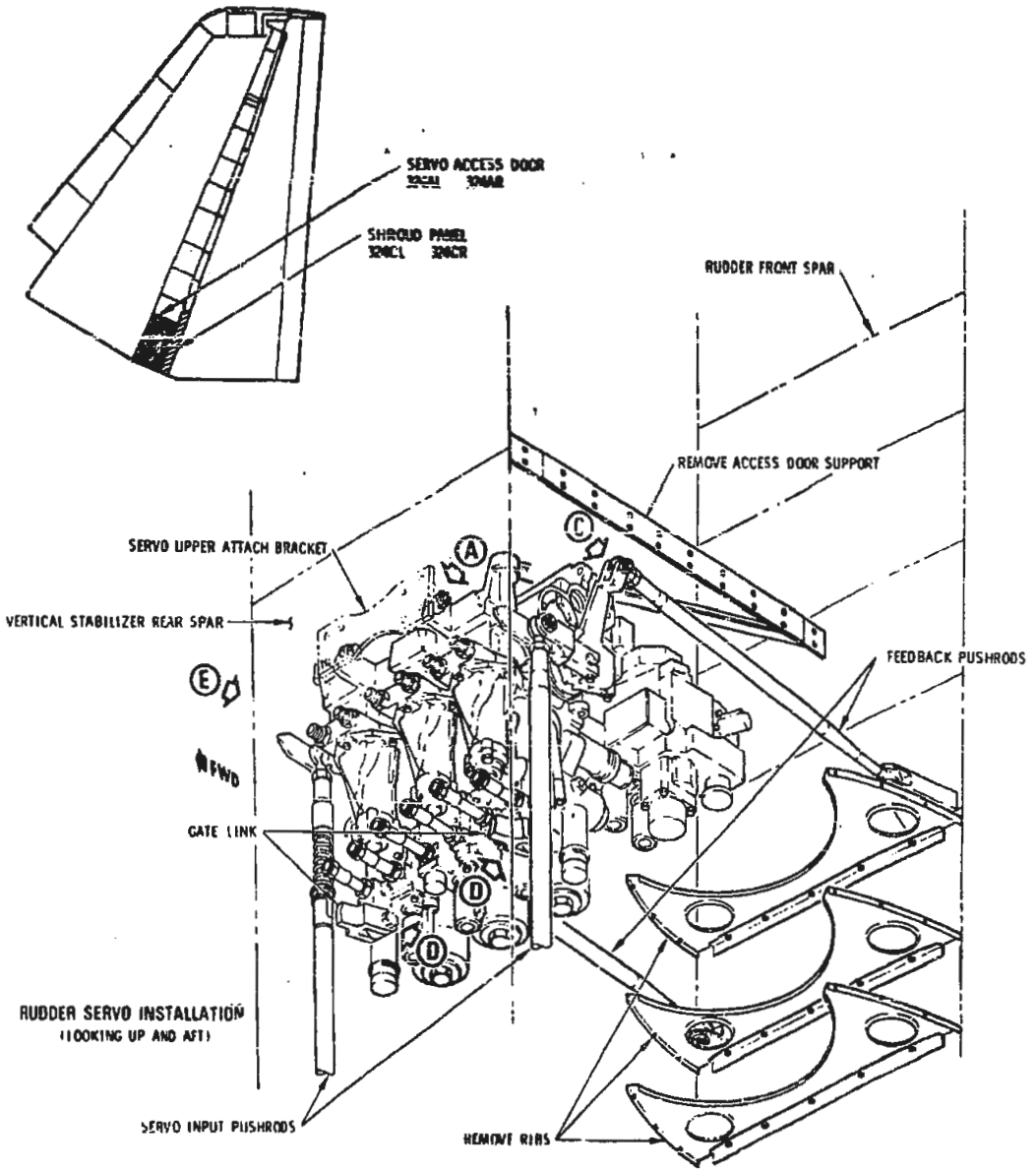
(6) Pitch auto-pilot

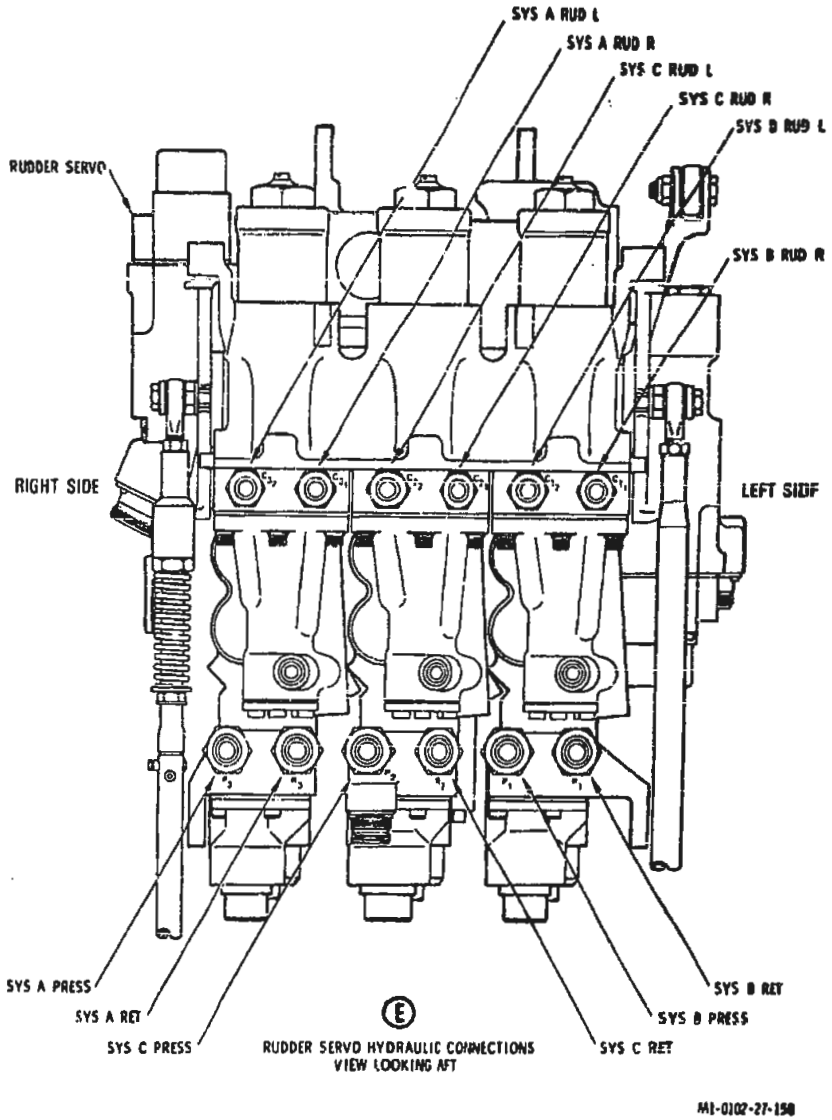
(a) Open access door 316DB. (Ref. Fig. 611 and 6-40-00).

(b) Disconnect return line of system that is gaining fluid and cap return line. Prepare to catch fluid from servo in a small container.

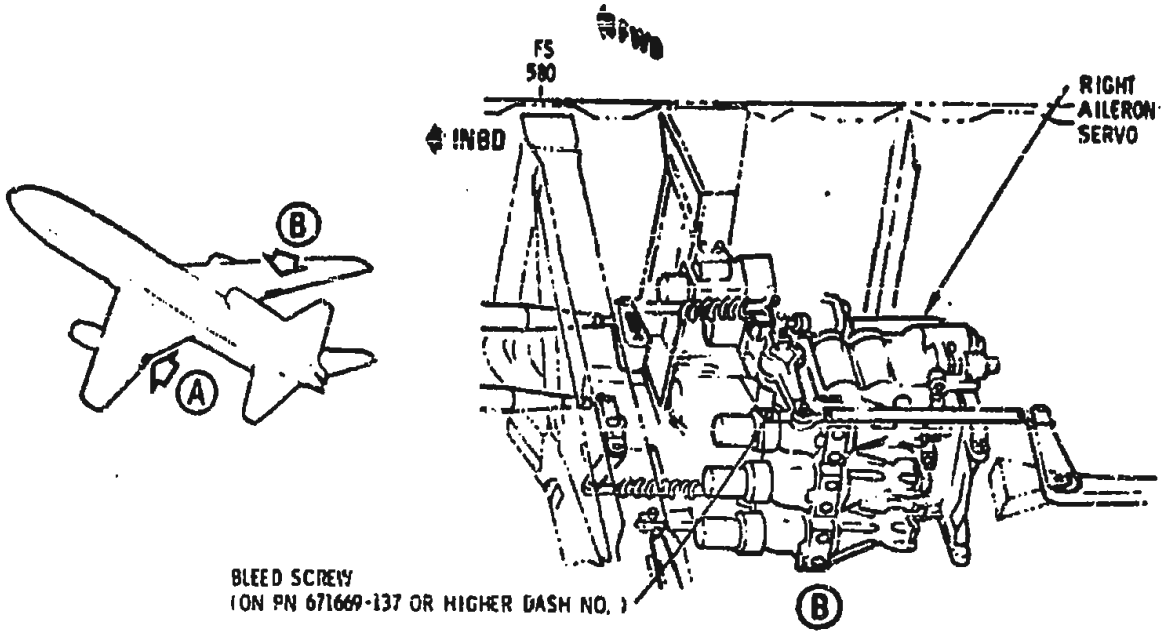
(c) Pressurize system that is losing fluid. (Ref. 29-11-00).

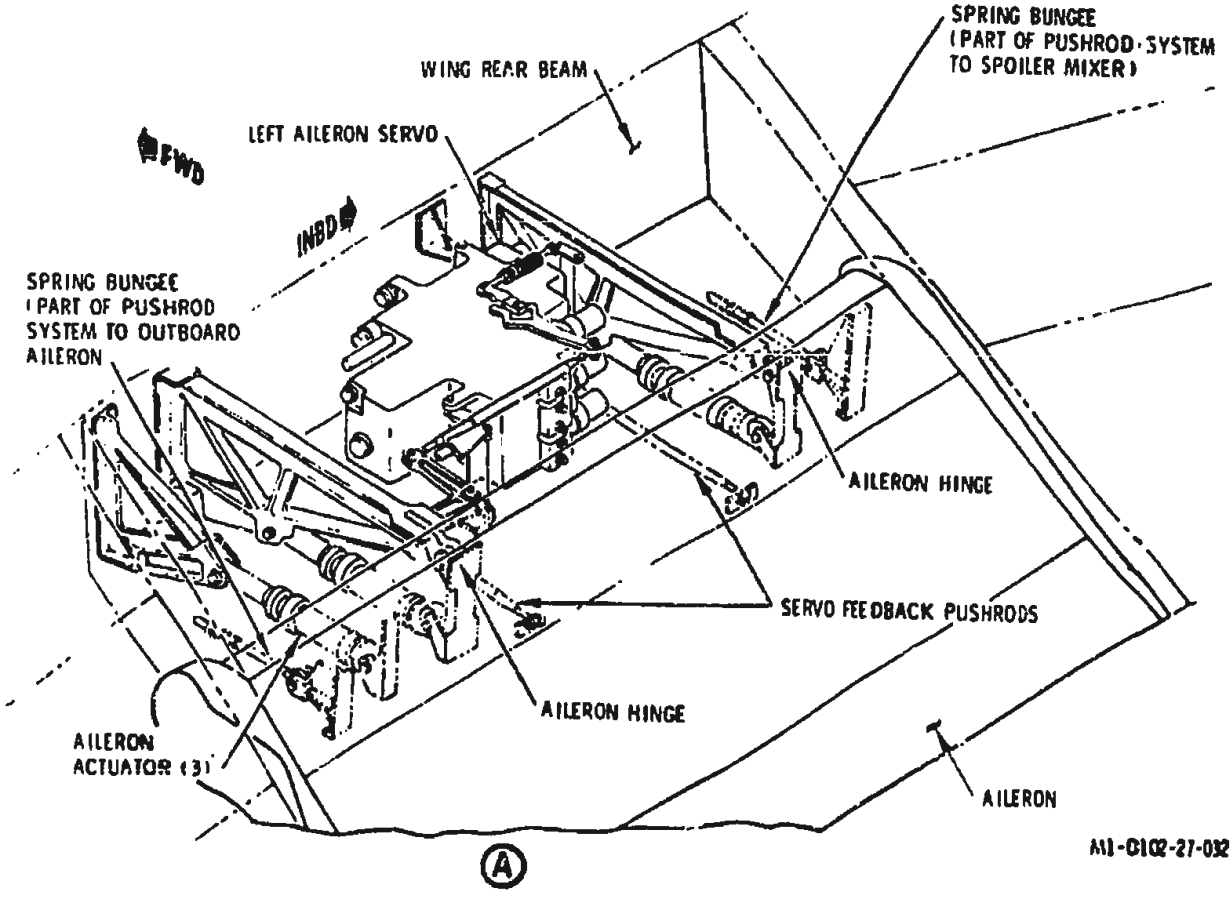
(d) If flow is within limits, remove hydraulic system pressure, (Ref. 29-11-00), reconnect return line and close access door.



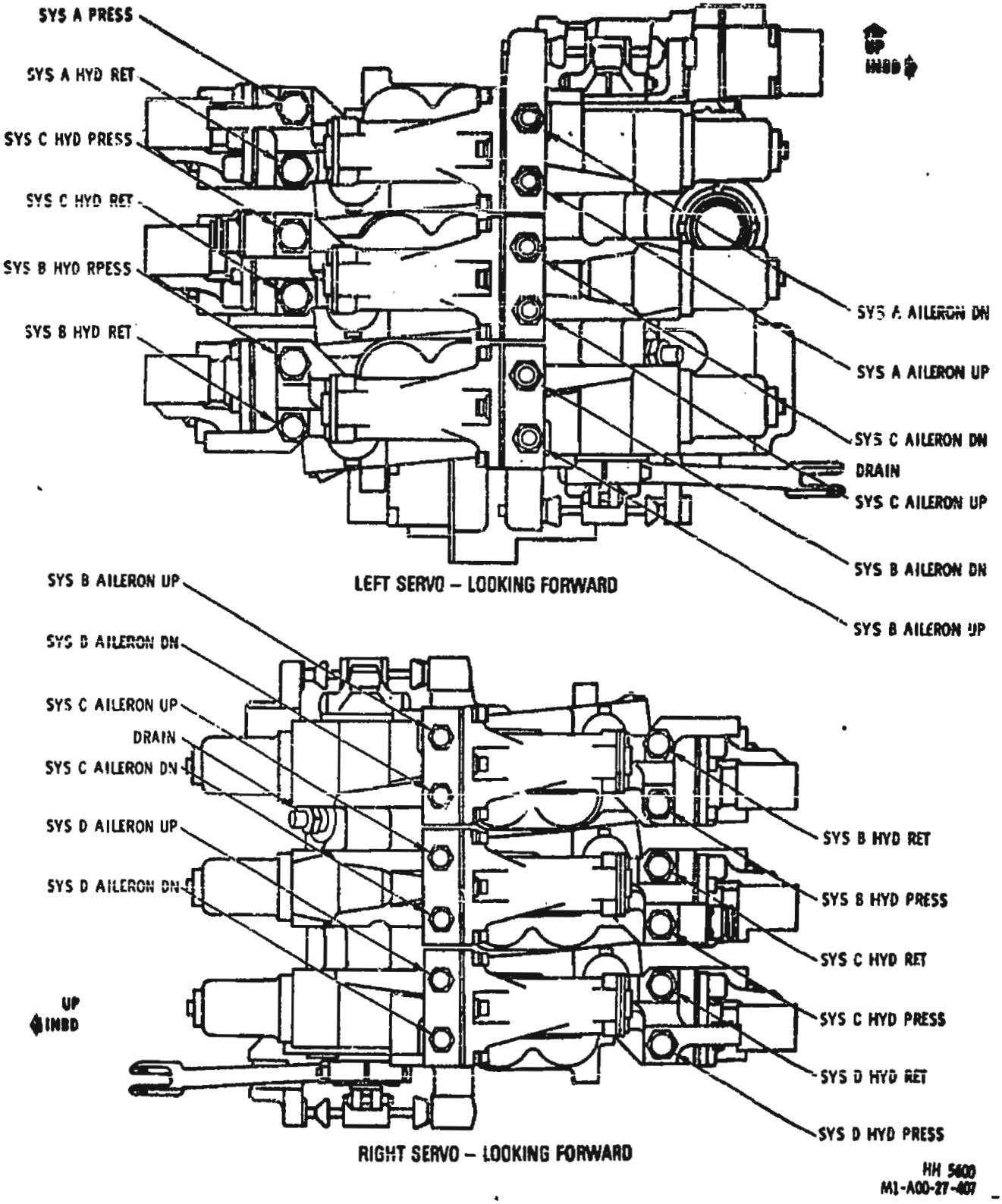


Rudder Servo Control Module
Figure 606

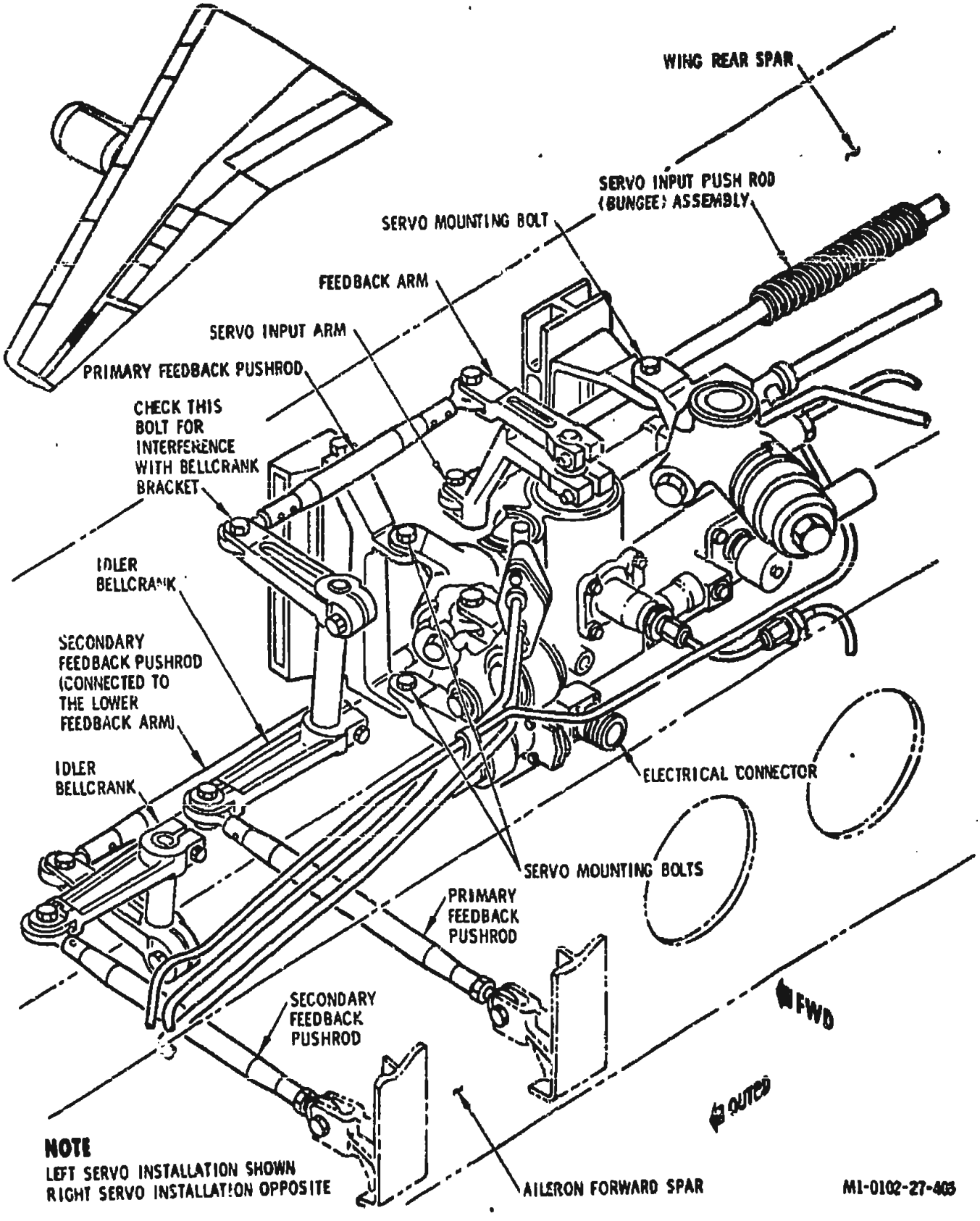




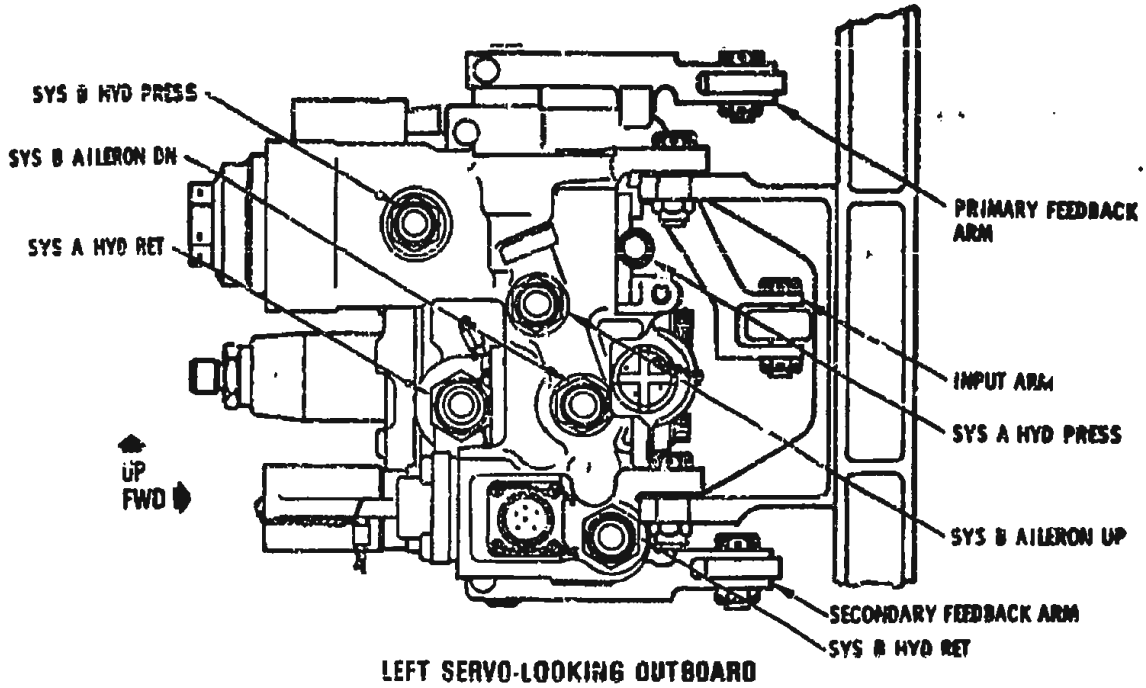
Inboard Aileron Servo
Figure 607 (Sheet 1)



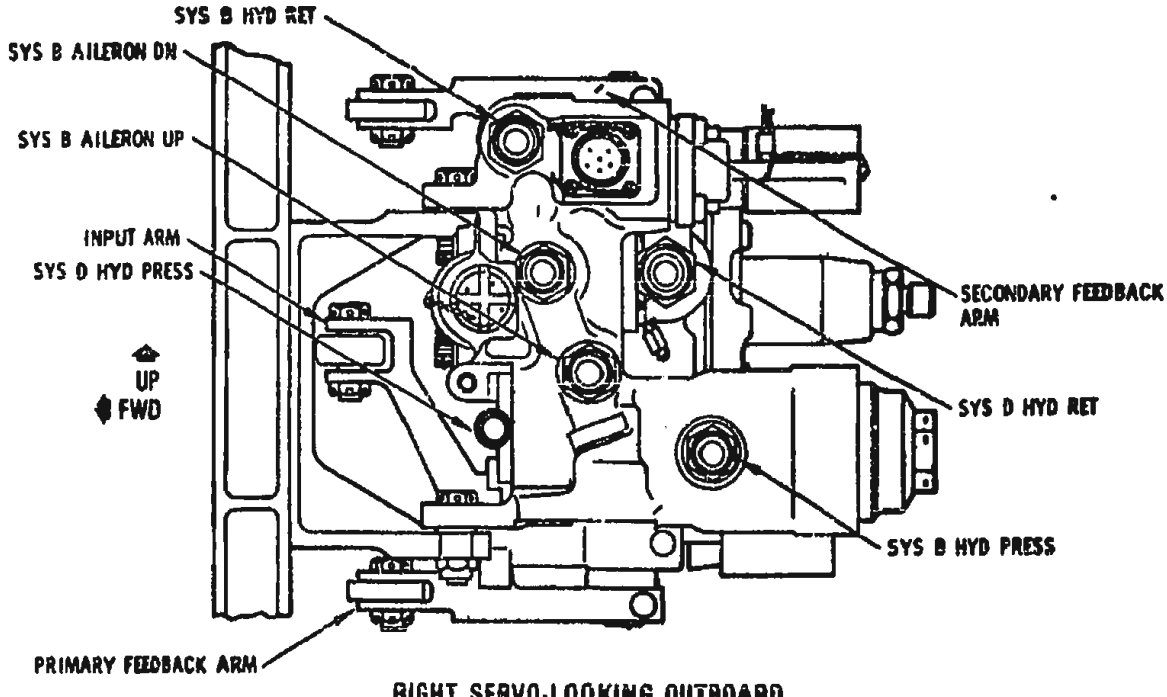
Inboard Aileron Servo
Figure 607 (Sheet 2)



Outboard Aileron Servo
Figure 608 (Sheet 1)



LEFT SERVO-LOOKING OUTBOARD



RIGHT SERVO-LOOKING OUTBOARD

HH 5601
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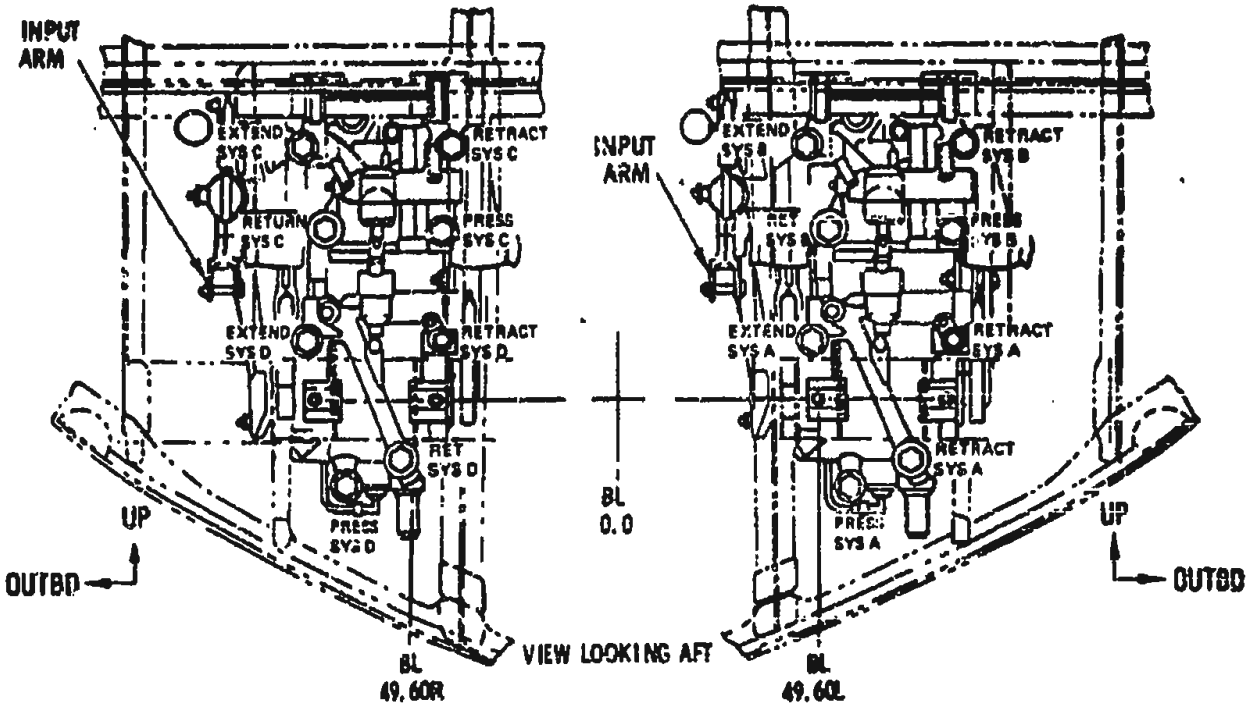
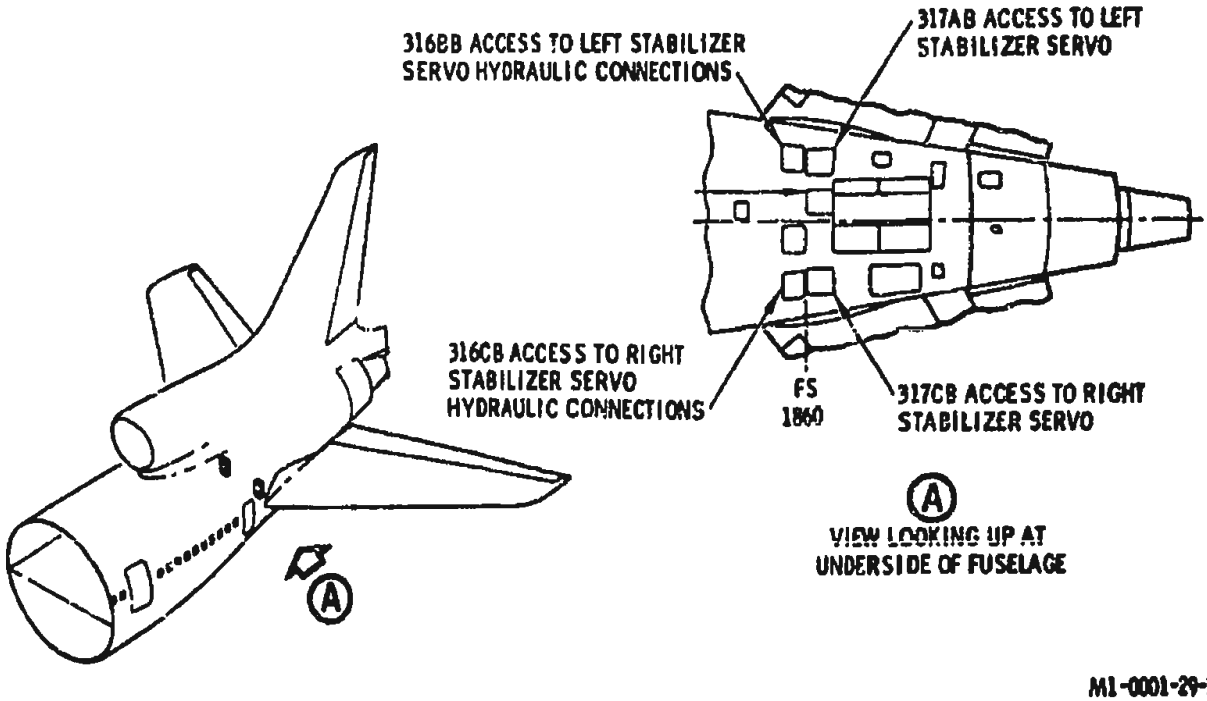
Outboard Aileron Servo
Figure 608 (Sheet 2)



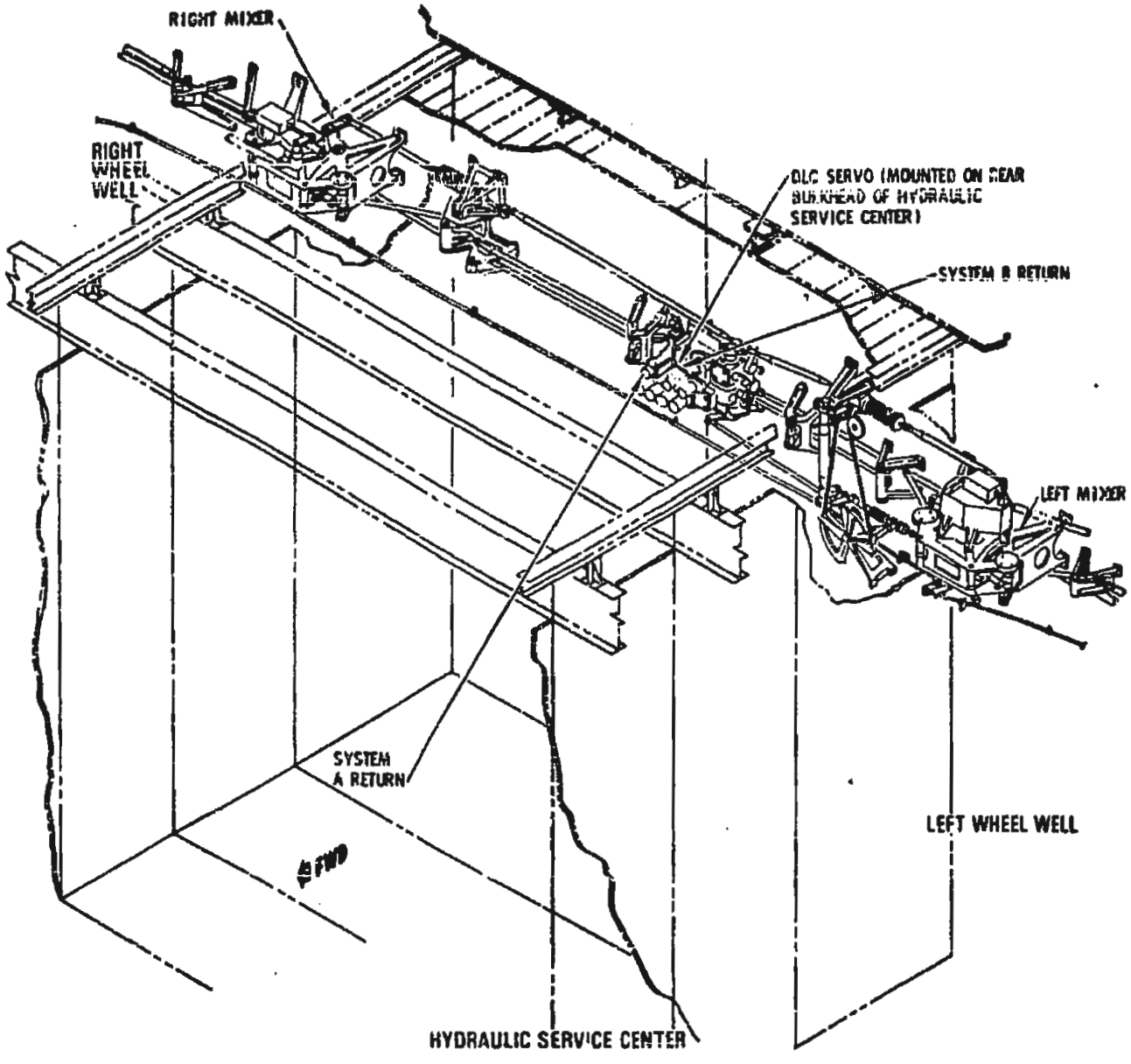
RIGHT SERVO HYDRAULIC CONNECTIONS

LEFT SERVO HYDRAULIC CONNECTIONS

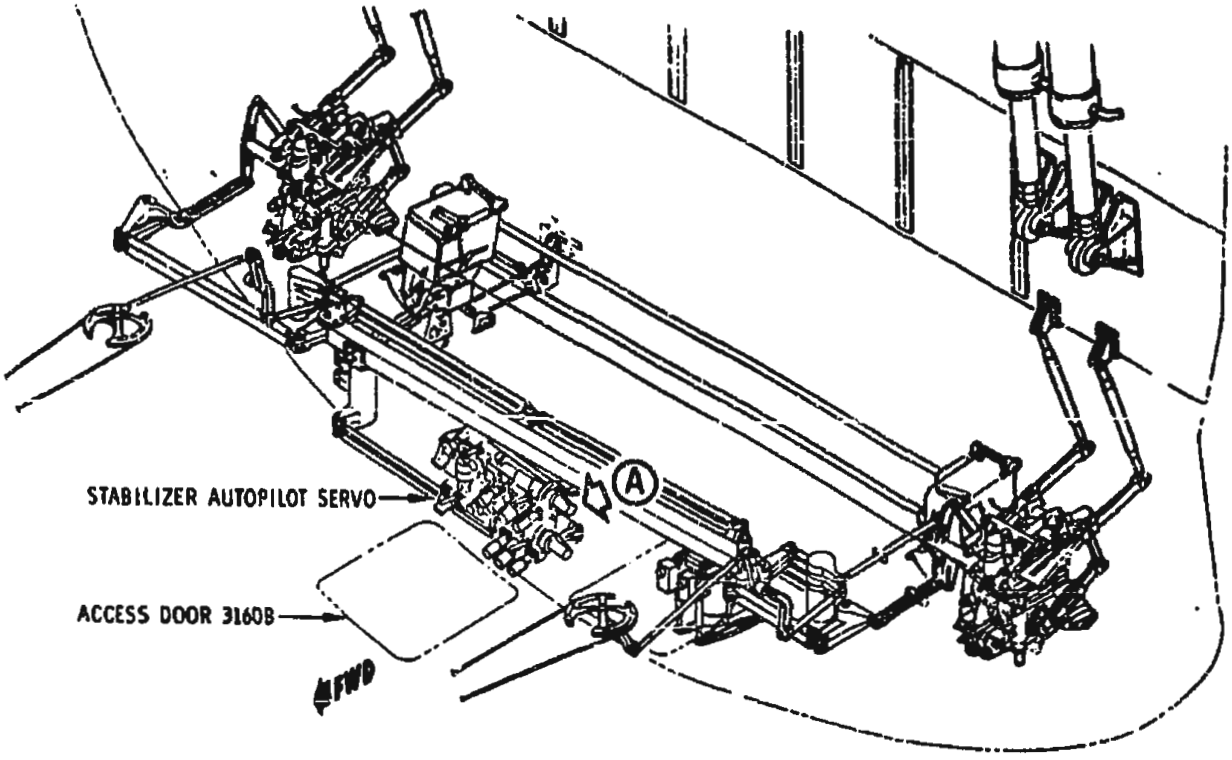

316BB ACCESS TO LEFT STABILIZER SERVO HYDRAULIC CONNECTIONS
317AB ACCESS TO LEFT STABILIZER SERVO
316CB ACCESS TO RIGHT STABILIZER SERVO HYDRAULIC CONNECTIONS
FS 1860
317CB ACCESS TO RIGHT STABILIZER SERVO
A
A
VIEW LOOKING UP AT UNDERSIDE OF FUSELAGE

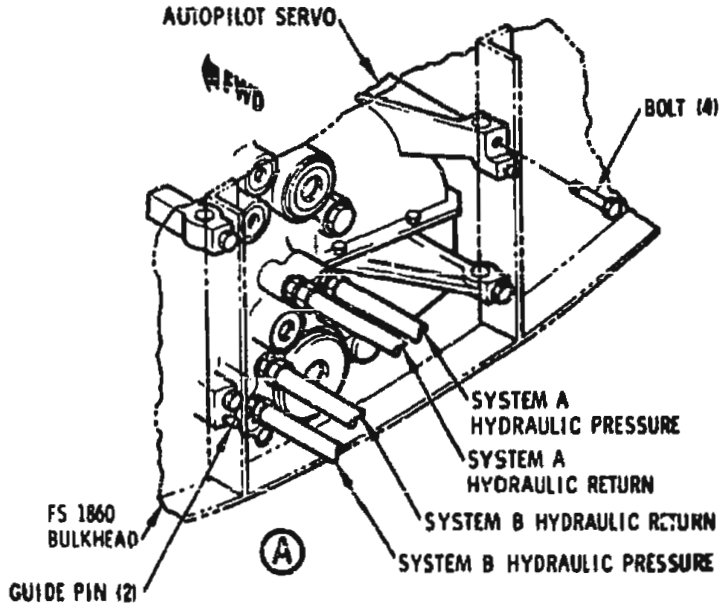
M1-0001-29-378

Horizontal Stabilizer Servo
Figure 609



Direct Lift Control Servo
Figure 610





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Pitch Auto Pilot Servo
Figure 611

R EFFECTIVITY: ALL
R
001B

HYDRAULIC BOOTSTRAP RESERVOIR ASSEMBLY REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (6 gallons, minimum) for systems A, B, and D

Fluid container (12 gallons, minimum) for systems C

Protective caps

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedure

R	6-40-00	Exterior Access Doors and Panels
R	12-13-01	Hydraulic Fluid Replenishing
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF. 29-11-00).

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag the following applicable circuit breakers:

R HYDRAULIC-QTY-TEMP-PRESS IND LT

R INDICATORS-

R QTY (M12)

R PRESS (M13)

R SYS A-

R RSVR (M14)

R SYS B-

R RSVR (M16)

R SYS C-

R RSVR (M18)

R SYS D-

R RSVR (M20)

R HYDRAULIC-ATM PUMP

R AC PUMP B3 (L12)

R PTU CONT & IND

R SYS B-A (L14)

R SYS C-D (L15)

R HYDRAULIC-ATM PUMP

R AC PUMP C3 (L22)

NOTE: Removal and installation procedures for each of the four hydraulic system reservoirs are identical. The following procedure uses system A reservoir as an example. Substitute the applicable system reference as required for system B, C, or D reservoir.

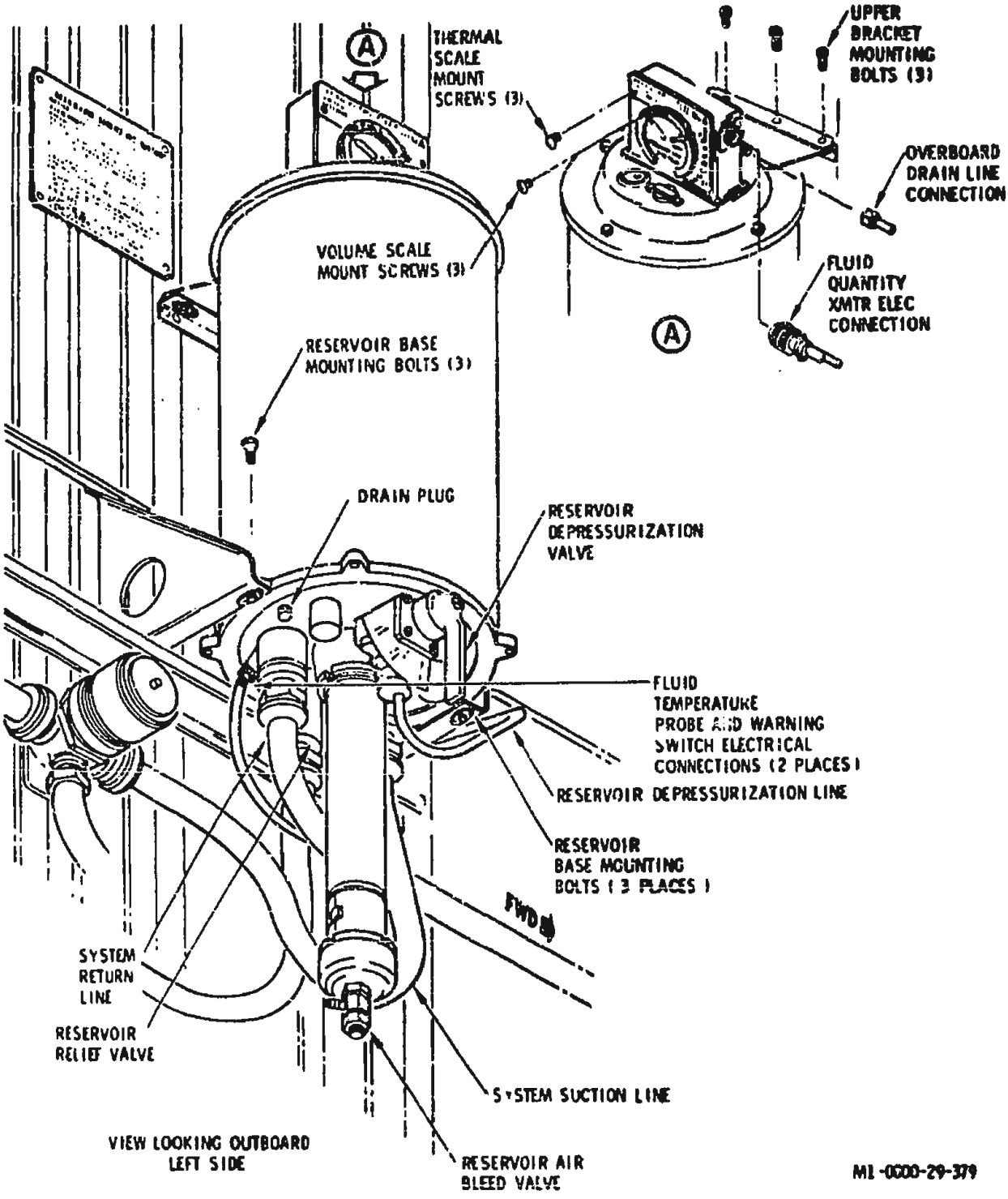
(2) Open hydraulic service center access doors 147AB and
R 147BB (Ref. 6-40-00).

R (3) Verify that the applicable reservoir is depressurized
R (Ref. 29-11-00).

R (4) Position applicable container under reservoir drain
R port remove drain plug, open reservoir air bleed valve,
R and drain reservoir (Ref. Fig. 401).

R (5) Disconnect following electrical connectors from
R reservoir: fluid quantity transmitter, fluid
R temperature warning switch, and fluid temperature
R probe.

R (6) Remove and retain for the replacement reservoir the
R fluid volume scale and the thermal scale as follows:


THERMAL SCALE MOUNT SCREWS (3)
UPPER BRACKET MOUNTING BOLTS (3)
OVERBOARD DRAIN LINE CONNECTION
FLUID QUANTITY XMTR ELEC CONNECTION
VOLUME SCALE MOUNT SCREWS (3)
RESERVOIR BASE MOUNTING BOLTS (3)
DRAIN PLUG
RESERVOIR DEPRESSURIZATION VALVE
FLUID TEMPERATURE PROBE AND WARNING SWITCH ELECTRICAL CONNECTIONS (2 PLACES)
RESERVOIR DEPRESSURIZATION LINE
RESERVOIR BASE MOUNTING BOLTS (3 PLACES)
FWD
SYSTEM RETURN LINE
RESERVOIR RELIEF VALVE
SYSTEM SUCTION LINE
VIEW LOOKING OUTBOARD LEFT SIDE
RESERVOIR AIR BLEED VALVE
M1-0000-29-379

Hydraulic Bootstrap Reservoir - Removal and Installation
Figure 401

(a) Remove the three mounting screws from the quantity transmitter fluid volume scale window. Remove the window and the fluid volume scale. Retain the scale for installation on the new transmitter and reinstall the window on the transmitter.

(b) Remove the three mounting screws from the quantity transmitter thermal scale. Retain the thermal scale for installation on the new transmitter.

R R (7) Disconnect hydraulic connectors from reservoir fittings.

R R R R (8) Remove reservoir base and upper support bracket mounting bolts, deflect reservoir pressurization line to obtain clearance, and remove reservoir. (Reservoir weighs approximately 30 pounds.)

R R (9) Install protective caps on all exposed hydraulic lines and fittings and electrical connectors.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged, and check that:

(a) All applicable ports, connectors, and mounting surfaces are clean

(b) Reservoir drain plug is installed and lock-wired

(c) Protective caps are removed from hydraulic lines and fittings and electrical connectors.

(2) Place reservoir on mounting brackets and start hydraulic line connectors while reservoir can be moved to make connecting lines easier, install reservoir mounting bolts (three each on base and upper support bracket).

(3) Tighten hydraulic lines and electrical connectors, and lock-wire as required.

(4) Install the applicable system fluid volume scale and thermal scale as follows:

(a) Remove the three mounting screws from the fluid volume scale window. Remove the window and install the applicable hydraulic system fluid volume scale. Install the window and secure with mounting screws.

(b) Install the applicable hydraulic system thermal scale and secure with mounting screws.

(5) Remove tags and close circuit breakers opened in Step 3A(1).

(6) Fill reservoir to full level and bleed system of air in accordance with RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(7) While applicable system is pressurized [Ref. Step 3B(6)], observe that approximately 85 psi is indicated on applicable SYS RESERVOIR PRESSURE gage on HYDRAULIC SERVICE PANEL. Operate reservoir depressurization valve at base of reservoir and verify that valve operates smoothly to the reservoir pressurized position. Check all fittings for evidence of leakage.

(8) Check fluid quantity transmitter operation by comparing quantity indications on the reservoir direct-reading gage with the HYDRAULIC SERVICE PANEL RESERVOIR QUANTITY indicator, zone 147, and the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel FLUID QUANTITY indicator, zone 215, for the applicable system.

R (9) Turnoff hydraulic power (Ref. 29-11-00). Do not actuate the reservoir depressurization valve. Note that reservoir pressure indication on the hydraulic service center panel does not bleed off rapidly.

(10) Turn off electrical power if no longe required (Ref. 24-41-00).

(11) Close and lock hydraulic service center access doors (Ref. 6-40-00).

C ENGINE-DRIVEN HYDRAULIC PUMP - MAINTENANCE PRACTICES

C 1. General

R CAUTION: ENGINE DRIVEN PUMP AND FILTERS MUST BE REPLACED IF
R ASSOCIATED FIRE PULL HAS BEEN ACTIVATED IN FLIGHT.
R CHECK FLUID IN PUMP FLEX HOSES FOR SLUDGE AND METAL
R PARTICLE CONTAMINATION.

R NOTE: Engine driven pump and filters need not be replaced if
R fire pull handle is used to shut down engine from ground
R idle.

This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MEL.

C A. An inoperative engine driven B-1 pump can be deactivated by
C removing the pump coupling shaft and installing a seal and
C cap engine pump pad to contain pump coupling shaft lub oil.

C B. If a C-1 pump in inoperative and a replacement pump is not
C available, use the B-1 pump in the C-1 position. Deactivate
C the C-1 pump, and install in the B-1 position.

C 2. Equipment and Materials

C Blanking Plug Assembly LK59627

C 3. Referenced Procedures

C 29-11-00 Hydraulic Power Systems - Maintenance Practices

C 29-11-07 Engine-driven Hydraulic Pump - Removal and
C Installation

C 4. Deactivation

C A. Hydraulic Pump B-1 Removal

C (1) Depressurize Hydraulic System B.

C (2) Open lower cowl panels 433 AL and 434 AR on engine No. 2.

C WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
C HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR
C PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF.
C 29-11-00, 201).

C CAUTION: USE EXTREME CARE TO PREVENT DAMAGING THE HYDRAULIC
C HOSES BY BENDING, KINKING OR TWISTING. DO NOT
C SUPPORT WEIGHT OF PUMP FROM HOSES. PREVENT
C INTRODUCTION OF TWISTING PRELOAD IN HOSES WHEN
C TIGHTENING FITTINGS.

C (3) Remove the inoperative hydraulic pump but do not
C disconnect hydraulic hoses except as necessary to
C rotate pump for removal (Ref. 29-00-07).

C (4) Remove the hydraulic pump coupling shaft.

C NOTE: The coupling shaft is held in the pump drive shaft by
C a spring retainer ring. Removal is accomplished by
C pulling shaft out of drive shaft. If coupling shaft
C has sheared, verify that both sections of coupling
C shaft are removed.

C B. Hydraulic Pump B-1 Deactivation.

CR (1) Lubricate blanking plug seal with engine oil.

CR (2) Insert blanking plug into engine accessary drive shaft
CR until plug bottoms out. Tighten blanking plug bolt to
CR lock plug into the drive shaft.

C C. Hydraulic Pump B-1 Installation

C (1) Verify that the pump mounting pad gasket is clean and
C in good condition.

C (2) Reinstall the inoperative pump; tighten all connections
C (Ref. 29-11-07).

C (3) Pressurize applicable hydraulic system using AC pump B3
C and check all connections for leakage (Ref. 29-11-00).

C (4) Check system B reservoir fluid level and replenish if
C required (Ref. 12-13-01).

C (5) Place INOPERATIVE placard on the HYDRAULIC SYSTEM
C control panel for the inoperative pump.

C (6) On Flight Engineer/Second Officers HYDRAULIC SYSTEM
C control panel, zone 215, release B-1 Suction S/O
C switchlight (flowbar extinguished) for system B
C engine-driven hydraulic pump.

C (7) Close engine cowl panels.

C (8) Make appropriate entry in aircraft log book.

CR D. Blanking Plug Removal

CR NOTE: Pump removal must be performed prior to blanking plug
CR removal.

CR (1) Loosen blanking plug bolt.

CR (2) Pull plug assembly from drive shaft.

C 5. Engine Driven Hydraulic Pump Failures

C A. The following is required when engine driven hydraulic pump
C failures occur:

C (1) Replace the pump and the pressure and case drain filter
C elements. Flush the lines from the pump to the case
C drain and pressure filters with the system hydraulic
C fluid. Do not use cleaning fluids of any type for
C flushing.

C (2) Assure the pump case and the hoses to the pump are
C filled with fluid and the applicable hydraulic
C reservoir is pressurized.

C NOTE: Failure to pressurize the reservoir and properly
C bleed the pump after a new or reinstallation of
C a pump has lengthened the installation time
C considerably. In many cases a second pump is
C installed before it is realized what the problem
C really is. The hydraulic pump does not pump air
C very well. It should always be bled of all air
C both in the air inlet supply line and the pump
C case before attempting any rotation of the drive
C shaft. The supply line and case may be
C effectively bled by hand filling and/or by
C cracking the pump supply line (inlet) at the
C pump until a steady flow of fluid is observed.
C Filling of the pump case and eliminating a
C potential air lock of the pump may now be
C accomplished by cracking the case drain line,
C and pressurizing the reservoir. The fluid will
C now flow from the supply line, thru the piston
C shoe lube ports, thru the case housing and out
C the case drain port.

C CAUTION: THE OPERATION OF A HYDRAULIC PUMP WITHOUT FILLING
C THE CASE WITH HYDRAULIC FLUID IS AS DETRIMENTAL AS
C OPERATING AN AUTOMOBILE ENGINE WITH NO OIL IN THE
C CRANK CASE EVEN FOR A VERY SHORT TIME.

C (3) Perform reservoir servicing, reservoir air check, and
C reservoir air bleed as required after the new pump has
C been operated and all leaks corrected.

C B. To prevent pump damage during engine start, the following
C steps are required whenever an engine is changed.

C (1) Assure the pump case and the hoses to the pump are
C filled with fluid and the applicable hydraulic
C reservoir is pressurized before starting the engine.

C CAUTION: REFER TO CAUTION AND NOTE ABOVE.

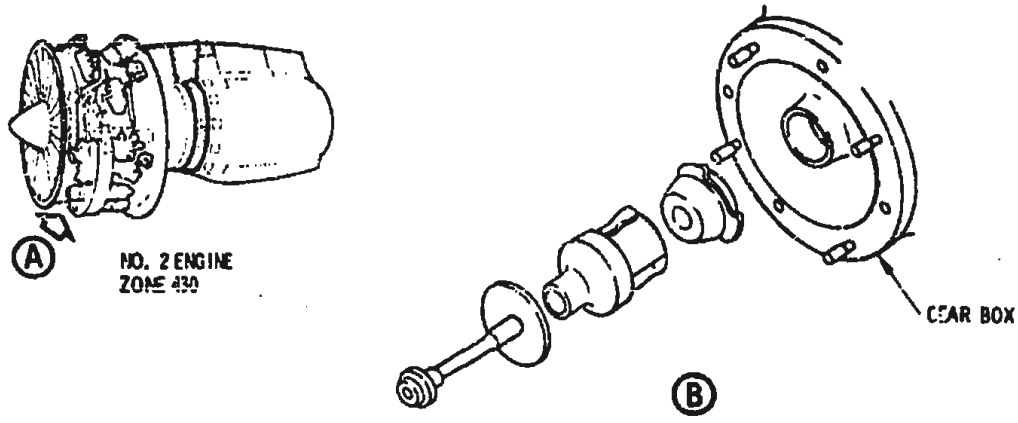
C (2) Perform reservoir servicing, reservoir air check, and
C reservoir air bleed as required after the new pump has
C been operated and all leaks corrected.

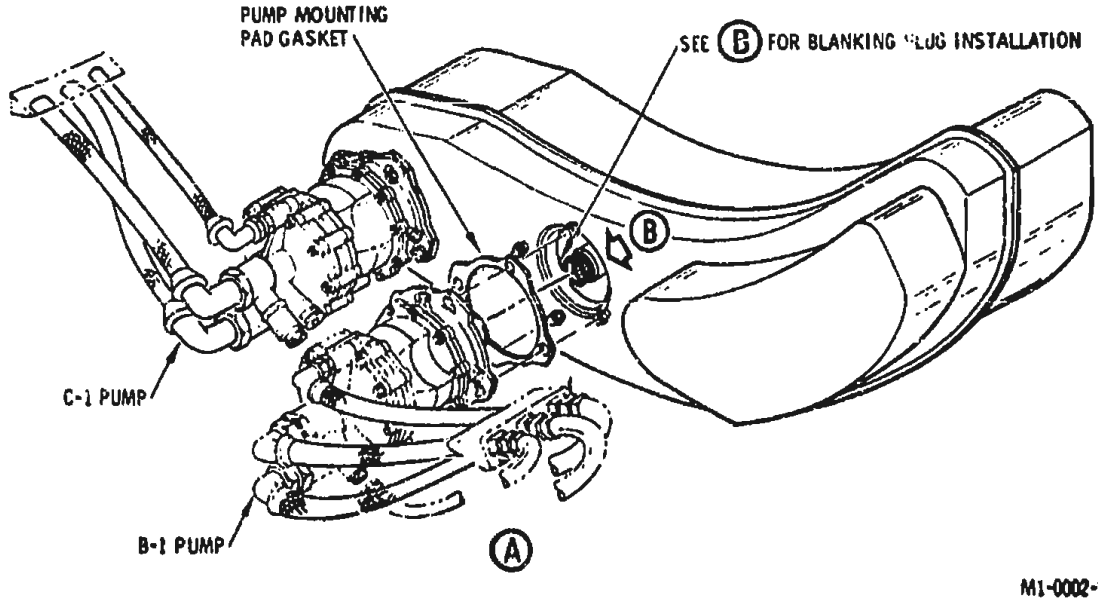
C CAUTION: GROUND CHECK OF THE SUCTION SHUT-OFF VALVE WHILE THE
C ENGINE IS RUNNING IS LIMITED TO 30 SECONDS "OFF"
C MAXIMUM.

C C. The reservoir depressurization valve has a tendency to stick
C in the partially depressurized position. If this occurs,
C the reservoir cannot pressurize and pump will cavitate. If
C the reservoir pressurization indication on the hydraulic
C service center panel does not indicate at least 70 PSI when
C the system is pressurized, depress the valve button and
C assist the valve to reseat by physically pulling on the
C valve button.

C D. Pumps can be damaged by air introduced into the system
C during any hydraulic unit change. After a hydraulic unit
C has been changed, a thorough operation of the sub system
C involved should be made to assure that all air is worked out
C of the lines and back to the reservoir. The mechanic shall
C then perform reservoir servicing, reservoir air check, and
C reservoir air bleed.

C E. Once source of air being introduced into the reservoir may
C be the jumper hose procedure used to equalize reservoir
C levels due to the cross transfer problem being experienced.
C If the jumper hose procedure has been used, the mechanic
C shall perform reservoir servicing, reservoir air check, and
C reservoir air bleed.





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CR Engine - Driven Hydraulic Pump B-1 Cap and Seal Installation
CR Figure 201

EFFECTIVITY: ALL

0038

ENGINE-DRIVEN HYDRAULIC PUMP - REMOVAL AND INSTALLATION

1. Equipment and Materials

CR Preformed packings, NAS1612-8, -16, -20 (pump port adapter
CR fittings), LS15794-216 and 2-119V747-75 (coupling shaft seals),
CR or equivalent

Protective plugs and caps

Jumper Hose and Dynatube adapters -20 to -16 and -20 to -10

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Wrench, check valve, P/N AA-9221-16SE1, Aircraft Porous Media, Inc., or equivalent

Hydraulic Ground Test Cart, B784C, or equivalent (10 GPM minimum)

Hydraulic Servicing Dolly (Ref. GTEL, 12-13-03), or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Fluid container, 5 gallon plastic pail or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-13-01	Hydraulic Fluid Replenishing.
20-00-06	Safetying Practices - LCP71-1098A
24-41-00	External Power/Ground Service System - Maintenance Practices
29-00-00	Hydraulic Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-11-17	High-pressure Filter Housing Assembly (Engine-Driven Pumps) - Removal and Installation
29-11-23	Case Drain Filter Module - Removal and Installation
29-11-28	Case Drain Filter Element - Removal and

3. Removal/Installation

A. Removal

CAUTION: USE EXTREME CARE TO PREVENT DAMAGING HYDRAULIC HOSES BY BENDING, KINKING OR TWISTING. DO NOT SUPPORT WEIGHT OF COMPONENTS FROM HOSES. PREVENT INTRODUCTION OF TWISTING PRELOAD IN HOSES WHEN TIGHTENING FITTINGS.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers as follows:

FUEL SHUTOFF VALVE

R TANK ENG 1 (D10)

R TANK ENG 2(D11)

R TANK ENG 3(D12)

R PR1 EMER 2 (D14)

R FIRE EXTINGUISHER

R ENG 1 MAIN(C10)

R ENG 1 ALTN(C11)

R ENG 2 MAIN(C12)

R ENG 2 ALTN(C13)

R ENG 3 MAIN(C14)

R ENG 3 ALTN(C15)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breakers as follows:

FUEL SYSTEM

R ENG 1 EMER & LX FEED (T7)

R ENG 2 SEC EMER CX FEED (T10)

R ENG 3 EMER & RX FEED (T13)

R (2) On pilots overhead circuit breaker panel CB1, zone 210,
R verify following circuit breakers are closed:

R HYD PUMP & FIREWALL SHUTOFF VALVE CONT

R SYS A(L15)

R SYS B(L16)

R SYS C(L17)

R SYS D(L18)

(3) Turn on electrical power (Ref. 24-41-00).

(4) Pull and tag the appropriate engine FIRE PULL handle to close the hydraulic pump shutoff valve.

R (5) Open and tag circuit breaker closed in Step 3A(2).

(6) Open cowl panels 413 and 414 for engine No. 1, 433 and 434 for engine No. 2, or 423 and 424 for engine No. 3, as applicable (Ref. 6-40-00).

CAUTION: WHEN CUTTING LOCK-WIRE SAFETYING ELECTRICAL CONNECTOR TO RECEPTACLE RETAINING JAM NUT, CARE MUST BE EXERCIZED TO AVOID CUTTING LOCK-WIRE SAFETYING JAM NUT TO SOLENOID BODY.

(7) Disconnect electrical connector from pump depressurization solenoid (Ref. Fig. 401).

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
R HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR
R PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF.
R 29-11-00).

(8) Place fluid container under pump hose fittings and disconnect suction, pressure, and case drain hoses from pump. Install plugs on hose fittings to minimize fluid drainage.

(9) Remove adapter fittings from pump ports if required for use on replacement pump. Discard O-ring packing seals.

(10) Install protective plugs in pump ports.

(11) Loosen (do not remove) pump mounting nuts to permit rotation of pump on gearbox mounting pad.

(12) Rotate pump clockwise until mounting nuts can pass through enlarged ends of pump mounting slots; move pump forward horizontally until pump coupling shaft is clear of gearbox drive splines and remove pump (pump weighs approximately 35 pounds).

(13) Flush pump pressure and case drain lines when an engine-driven pump is replaced for pump problem or
R failure that may have caused hydraulic system
R contamination (Ref. Para. 3B or 3C).

NOTE: If severe contamination of hydraulic system is suspected or is determined by hydraulic fluid inspection, perform system flushing procedure (Ref. 29-00-00).

B. Flushing Procedure for Pump Pressure and Case Drain Lines (Using Hydraulic Ground Test Cart)

(1) Disconnect pump pressure flex hose fitting at high-pressure filter assembly; attach a flushing hose directed into a used fluid container (5-gallon container).

(2) Connect pump end of pressure hose to pressure line of a hydraulic ground test cart.

(3) Adjust test cart flow rate to 10 gpm (min) and purge the line (from pump to filter) with approximately 2 gallons of hydraulic fluid.

(4) Shut off test cart and disconnect pump pressure hose from the ground test cart pressure line. Ensure hose is filled with hydraulic fluid and install protective cap on hose fitting.

(5) Disconnect flushing hose and reconnect pressure line to high pressure filter.

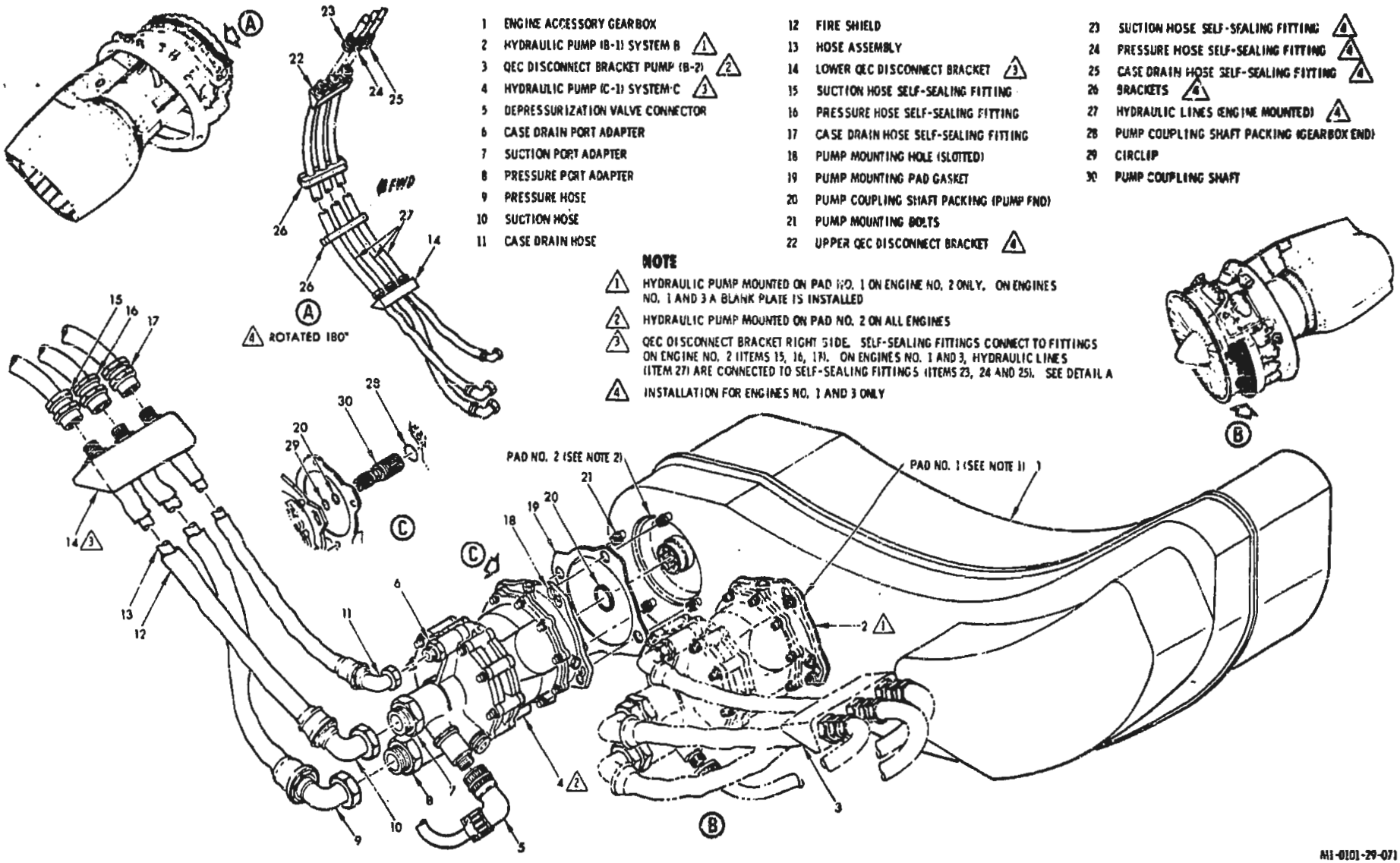
(6) Clean high-pressure filter housing (Ref. Para. 3E).

(7) Repeat Steps 3B(1) thru 3B(5) for case drain line from pump to case drain filter.

(8) Replace case drain filter module with a serviceable unit from stock (Ref. 29-11-23). If a serviceable unit is not available, clean the module as instructed in Para. 3D and reinstall in aircraft.

(9) Reset clogged filter popout indicator (if extended).

R (10) Proceed with pump installation, Para. 3F.


1 ENGINE ACCESSORY GEARBOX
2 HYDRAULIC PUMP (B-1) SYSTEM B (1)
3 QEC DISCONNECT BRACKET PUMP (B-2) (2)
4 HYDRAULIC PUMP (C-1) SYSTEM C (3)
5 DEPRESSURIZATION VALVE CONNECTOR
6 CASE DRAIN PORT ADAPTER
7 SUCTION PORT ADAPTER
8 PRESSURE PORT ADAPTER
9 PRESSURE HOSE
10 SUCTION HOSE
11 CASE DRAIN HOSE
12 FIRE SHIELD
13 HOSE ASSEMBLY
14 LOWER QEC DISCONNECT BRACKET (3)
15 SUCTION HOSE SELF-SEALING FITTING
16 PRESSURE HOSE SELF-SEALING FITTING
17 CASE DRAIN HOSE SELF-SEALING FITTING
18 PUMP MOUNTING HOLE (SLOTTED)
19 PUMP MOUNTING PAD GASKET
20 PUMP COUPLING SHAFT PACKING (PUMP END)
21 PUMP MOUNTING BOLTS
22 UPPER QEC DISCONNECT BRACKET (4)
23 SUCTION HOSE SELF-SEALING FITTING (4)
24 PRESSURE HOSE SELF-SEALING FITTING (4)
25 CASE DRAIN HOSE SELF-SEALING FITTING (4)
26 BRACKETS (4)
27 HYDRAULIC LINES (ENGINE MOUNTED) (4)
28 PUMP COUPLING SHAFT PACKING (GEARBOX END)
29 CIRCLIP
30 PUMP COUPLING SHAFT
NOTE
(1) HYDRAULIC PUMP MOUNTED ON PAD NO. 1 ON ENGINE NO. 2 ONLY. ON ENGINES NO. 1 AND 3 A BLANK PLATE IS INSTALLED
(2) HYDRAULIC PUMP MOUNTED ON PAD NO. 2 ON ALL ENGINES
(3) QEC DISCONNECT BRACKET RIGHT SIDE. SELF-SEALING FITTINGS CONNECT TO FITTINGS ON ENGINE NO. 2 (ITEMS 15, 16, 17). ON ENGINES NO. 1 AND 3, HYDRAULIC LINES (ITEM 27) ARE CONNECTED TO SELF-SEALING FITTINGS (ITEMS 23, 24 AND 25). SEE DETAIL A
(4) INSTALLATION FOR ENGINES NO. 1 AND 3 ONLY
(4) ROTATED 180°
FWD
PAD NO. 2 (SEE NOTE 2)
PAD NO. 1 (SEE NOTE 1)
A
B
C
AI-0101-29-071

R Engine-driven Hydraulic Pump - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

C. Flushing Procedure for Pump Pressure and Case Drain Lines (Using Jumper Hose and Aircraft System AC Motor Pump)

NOTE: The following procedure uses reservoir fluid and pressure from the pump suction line to flush contaminates from pump pressure and case drain lines between the pump and respective filters.

This procedure is to be used only if a hydraulic ground test cart is not available to supply flushing fluid pressure (Ref. Para. 3B).

R (1) On pilots overhead circuit breaker panel CB1, verify
R following circuit breakers are closed:

R HYD PUMP & FIREWALL SHUTOFF VALVE CONT

R SYS A(L15)

R SYS B(L16)

R SYS C(L17)

R SYS D(L18)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify following hydraulic circuit breakers are closed:

R ATM PUMP

R AC PUMP B3(L12)

R PTU CONT & IND - SYS B-A(L14)

R PTU CONT & IND - SYS C-D(L15)

R AC PUMP C3(L22)

(2) Turn on electrical power (Ref. 24-41-00).

(3) Replenish applicable reservoir with approximately 2 to 3 gallons of fluid or until reservoir is completely full (above normal full Ref. 12-13-01).

(4) Disconnect pump pressure flexhose fitting at the high-pressure filter assembly; attach a flushing hose directed into a suitable fluid container.

(5) Provide a jumper hose and adapters to connect the pump end of pump suction hose to pump pressure hose fitting.

(6) Open hydraulic pump firewall shutoff valve closed in Para. 3A(4) by removing tag and stowing engine FIRE PULL handle.

(7) Establish communication (interphone or signals) between hydraulic service center, HYDRAULIC SERVICE PANEL, and applicable engine-driven pump area.

CAUTION: DO NOT PERMIT HYDRAULIC RESERVOIR FLUID LEVEL TO GO BELOW THE LOW INDICATOR MARK.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on applicable AC MOTOR PUMP and PTU as required to pressurize the reservoir and affected pump suction line (Ref. HYDRAULIC SERVICE PANEL placard). Flush line with approximately 2 gallons of fluid.

(9) Shut off AC MOTOR PUMP and PTU.

(10) Close hydraulic firewall shutoff valve (Pull and tag engine FIRE PULL handle).

(11) Disconnect pump pressure hose from flushing hose and reconnect to filter assembly.

(12) Disconnect pump pressure hose from jumper hose adapter, verify pump pressure hose is filled with hydraulic fluid, and install a protective plug until replacement pump is installed.

(13) Clean high-pressure filter housing (Ref. Para. 3E).

R (14) Repeat Steps 3C(3) thru 3C(12) for case drain line from pump to case drain filter.

(15) Remove jumper hose and adapters from pump suction line. Verify suction line is filled with fluid, and install protective cap.

(16) Replace case drain filter module with a serviceable unit from stock (Ref. 29-11-23). If unit is not available, clean the module as instructed in Para. 3D and reinstall in aircraft.

(17) Replenish hydraulic reservoir (Ref. 12-13-01).

(18) Reset clogged filter popout indicator (if extended).

(19) Proceed with pump installation, Para. 3F.

D. Case Drain Filter Module Cleaning Procedure

NOTE: This cleaning operation is required after pump failure.

(1) Remove case drain filter module from aircraft (Ref. 29-11-23).

(2) Remove filter bowl; discard filter element and bowl preformed packings. Flush bowl and wipe with clean lint-free cloths (Ref. Fig. 402).

(3) Loosen and remove four mounting-screws on the differential pressure indicator switch and remove from filter housing.

(4) Insert screwdriver into indicator switch port of filter housing and remove setscrew.

(5) Unscrew and remove check valve assembly, preformed packing and boss seal.

(6) Remove adapter from filter housing.

(7) Flush all removed parts and filter housing, except the switches, using clean hydraulic fluid.

(8) Assemble preformed packing and boss seal on check valve assembly.

(9) Install preformed packing in filter head.

(10) Install adapter and check valve assembly into filter head. Hand-tighten check valve and tighten setscrew in indicator switch port until check valve assembly is locked in place.

(11) Install new preformed packings and retainers on differential pressure indicator switch; lubricate packings with hydraulic fluid.

(12) Install switch into filter housing port. Torque four mounting screws 30 to 33 pound-inches and safety with lock-wire.

(13) Install new filter element into filter housing, fill filter bowl with hydraulic fluid, and reinstall filter bowl (Ref. 29-11-28).

E. High Pressure Filter Housing Cleaning Procedure

NOTE: The following procedure applies following a pump failure and suspected metal chip contamination.

(1) Remove filter housing assembly (Ref. 29-11-17).

(2) Remove filter bowl (12) from filter head (6) and discard filter element and packing (13) (Ref. Fig. 403).

(3) Using check valve wrench, remove check valve assembly (11) from filter head.

(4) Remove shutoff diaphragm (9) and spring (7).

(5) Remove preformed packing (15) and packing retainers (14) from filter head.

(6) Remove preformed packings (8) and (10) from check valve and shutoff diaphragm.

(7) Remove screws (1) securing differential pressure indicator switch (2) to filter head and remove indicator switch.

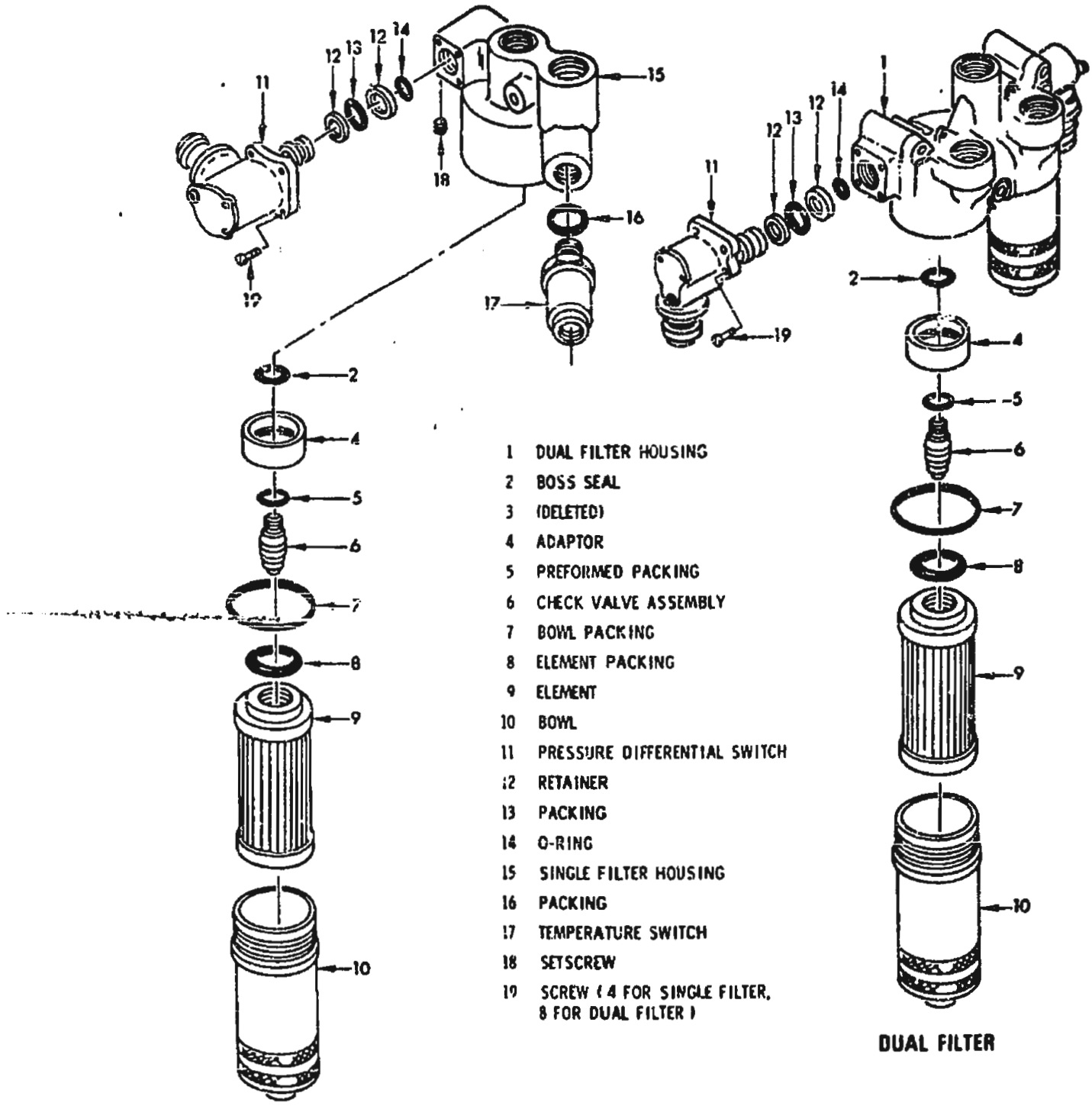
(8) Remove preformed packings (4 and 5) and packing retainers (3) from switch.

(9) Flush all removed parts (except indicator switch electrical parts) and filter head using clean hydraulic fluid.

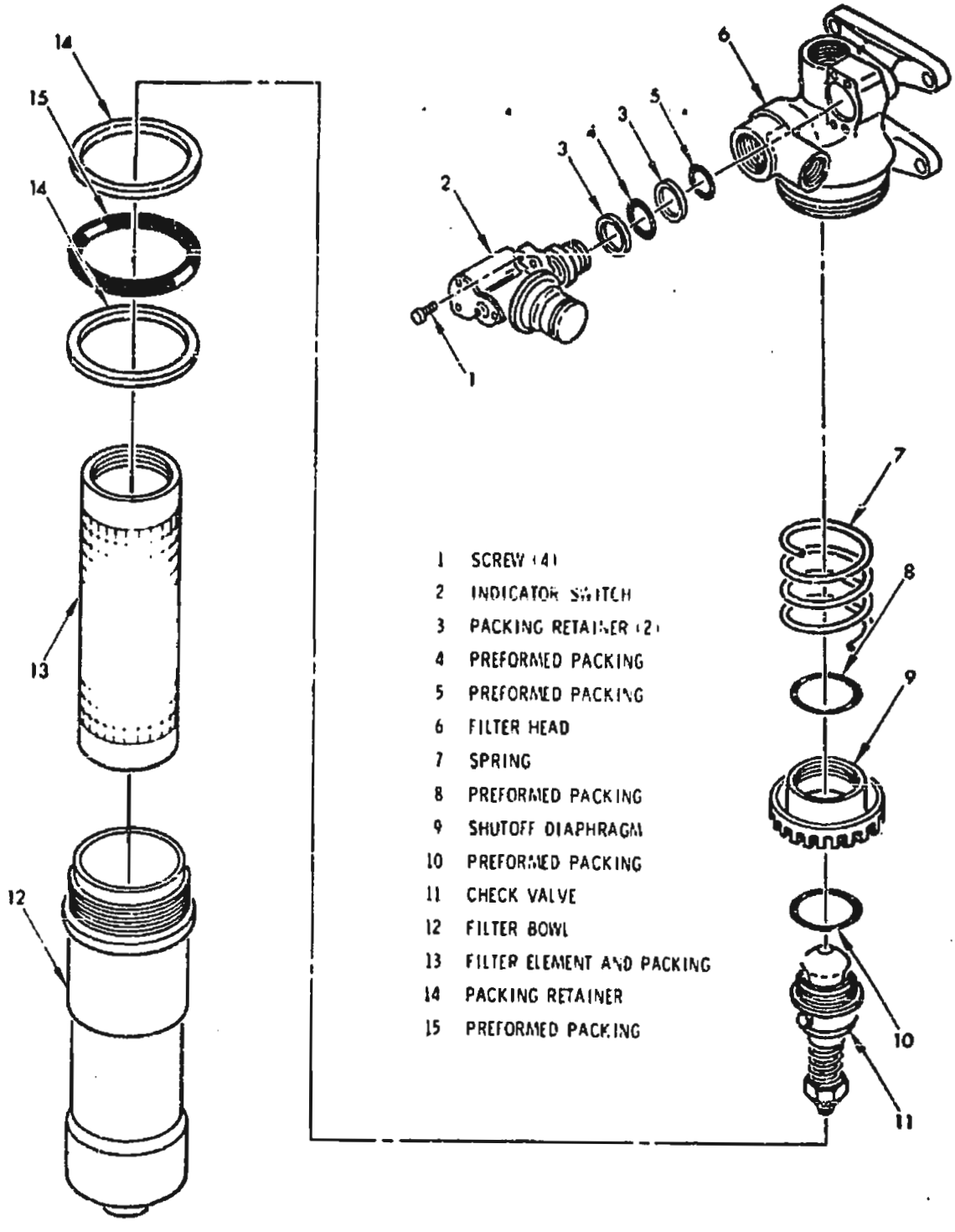
(10) Inspect all packings and retainers for damage and deformation; replace as required.

(11) Soak all new packings in hydraulic fluid for a minimum of 10 minutes.

(12) Install packing retainers and preformed packing on indicator switch.



Case Drain Filter Cleaning
Figure 402



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High Pressure Filter Housing Cleaning
Figure 403

(13) Insert indicator switch into filter head and secure with screws. Tighten screws to a torque of 30 to 33 lb in. Secure screws with lock-wire.

(14) Install packing retainers and preformed packing inside filter head.

(15) Install preformed packing inside shutoff diaphragm.

(16) Install preformed packing on check valve.

(17) Install spring and shutoff diaphragm into filter head and secure in place by installing check valve.

(18) Using check valve wrench, hand tighten check valve.

(19) Install filter element, with packing, into filter bowl.

(20) Fill filter bowl with clean hydraulic fluid. Install and secure filter bowl. Hand tighten and safety with lock-wire.

(21) Install filter housing assembly (Ref. 29-11-17).

F. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged, and check that:

(a) Engine gearbox pump mounting pad and pump mounting flange surfaces are clean

(b) Mounting gasket is in good condition and is lubricated with engine oil before installing pump.

(c) Pump case is filled with hydraulic fluid.

NOTE: If required, fill pump case through case drain port.

(d) Pump coupling shaft seals are installed.

(2) Lubricate packing seals (O-rings) with engine oil.

(3) With pump in horizontal mounting position, engage pump coupling shaft and engine drive coupling splines. Rotate, as required, to allow mounting nuts to pass through pump flange, and install pump against mounting pad.

(4) Rotate pump counterclockwise until small ends of flange mounting slots are firmly against engine gearbox studs.

CR (5) Tighten pump mounting nuts (290 ±30 lb.in.).

(6) Remove protective caps and plugs, and install adapter fittings in replacement pump ports using new O-ring packing seals lubricated with hydraulic fluid.

(7) Connect suction and pressure hoses to the pump fittings. Verify that pump case is filled with hydraulic fluid and connect case drain hose.

C NOTE: Ensure clearance exists between hydraulic lines
C and starter air duct on No. 2 engine.

(8) Connect electrical connector to depressurization solenoid valve; safety connector to receptacle retaining jamnut with lock-wire (Ref. 20-00-06). Also inspect lock-wire safetying jamnut to solenoid body to ensure integrity.

R (9) On pilots overhead circuit breaker panel CB1 verify
R that following circuit breakers are closed:

R HYD PUMP & FIREWALL SHUTOFF VALVE CONT

R SYS A(L15)

R SYS B(L16)

R SYS C(L17)

R SYS D(L18)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that the following hydraulic circuit breakers are closed:

R ATM PUMP

R AC PUMP B3(L12)

R PTU CONT & IND - SYS B-A(L14)

R PTU CONT & IND - SYS C-D(L15)

R AC PUMP B3(L22)

R HYDRAULIC

R INDICATORS - QTY(M12)

INDICATORS - PRESS(M13)

HYDRAULIC QTY-TEMP-PRESS IND LT

SYS A RSVR(M14)

SYS A PUMP(M15)

SYS B RSVR(M16)

SYS B PUMP(M17)

SYS C RSVR(M18)

SYS C PUMP(M19)

SYS D RSVR(M20)

SYS D PUMP(M21)

(10) Turn on electrical power (Ref. 24-41-00).

(11) On Flight Engineer/Second Officers HYDRAULIC SYSTEM
R panel, depress (latch in) the applicable system PUMP S/O switchlight (flowbar on).

R (12) Check operation of firewall shutoff valve and
R depressurization solenoid valve as follows:

(a) Gain access to the applicable system firewall shutoff valve:

access panels 453DR or 463DL for engines No. 1 or No. 3, and access panel 317BB for engine No. 2 (Ref. 6-40-00).

R (b) Operate applicable FIRE-PULL handle and verify
R operation of firewall shutoff valve and
R depressurization solenoid valve.

R Firewall shutoff valve manual lever must move to
R CLSD position when FIRE-PULL handle is pulled and
R OPEN position when FIRE-PULL handle is pushed in.

R Depressurization solenoid valve must be energized
R when FIRE-PULL handle is pulled and de-energized
R when FIRE-PULL handle is pushed in. Solenoid can
R be heard when it actuates and an increase in
R solenoid case temperature can be detected by hand
R contact when solenoid is energized.

R (c) Close FIRE-PULL handle.

R NOTE: Check of firewall shutoff valve is required because during certain types of hydraulic pump failures (valve closed prior to failure) the shutoff valve can be subjected to excessive hydraulic pressures that could preclude normal shutoff valve operation.

4. Pump Priming/Air Bleeding

A. Procedure

C CAUTION: FAILURE TO PRESSURIZE THE RESERVOIR AND PROPERLY
C BLEED THE PUMP AFTER A NEW OR REINSTALLATION OF A
C PUMP HAS LENGTHENED THE INSTALLATION TIME
C CONSIDERABLY. IN MANY CASES A SECOND PUMP IS
C INSTALLED BEFORE IT IS REALIZED WHAT THE PROBLEM
C REALLY IS. THE HYDRAULIC PUMP DOES NOT PUMP AIR
C VERY WELL.

C IT SHOULD ALWAYS BE BLED OF ALL AIR BOTH IN THE
C AIR INLET SUPPLY LINE AND THE PUMP CASE BEFORE
C ATTEMPTING ANY ROTATION OF THE DRIVE SHAFT. THE
C SUPPLY LINE AND CASE MAY BE EFFECTIVELY BLED BY
C HAND FILLING AND/OR BY CRACKING THE PUMP SUPPLY
C LINE (INLET) AT THE PUMP UNTIL A STEADY FLOW OF
C FLUID IS OBSERVED. FILLING OF THE PUMP CASE AND
C ELIMINATING A POTENTIAL AIR LOCK OF THE PUMP MAY
C NOW BE ACCOMPLISHED BY CRACKING THE CASE DRAIN
C LINE AND PRESSURIZING THE RESERVOIR. THE FLUID
C WILL NOW FLOW FROM THE SUPPLY LINE, THRU THE
C PISTON SHOE LUBE PORTS, THRU THE CASE HOUSING AND
C OUT THE CASE DRAIN PORT.

C CAUTION: THE OPERATION OF A HYDRAULIC PUMP WITHOUT FILLING
C THE CASE WITH HYDRAULIC FLUID IS AS DETRIMENTAL AS
C OPERATING AN AUTOMOBILE ENGINE WITH NO OIL IN THE
C CRANK CASE EVEN FOR A VERY SHORT TIME.

(1) Check applicable reservoir fluid level; replenish if required (Ref. 12-13-01).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) On HYDRAULIC SERVICE PANEL, zone 147, turn on applicable AC MOTOR PUMP (and PTU for SYS A or D).

NOTE: ATM B2 or C2 may be used instead of AC MOTOR PUMP.

(3) Verify that the applicable (replaced pump system) reservoir is pressurized (70-85 psi) and the depressurization valve is fully released.

(4) Perform system air bleed operation as follows:

(a) On the pilots overhead panel, position the PFCS panel RUDDER, STABILIZER AILERON, and SPOILER switchlights to OFF or INOP.

NOTE: Flight control servos are shut off to prevent air movement into flight control systems.

(b) Motor the applicable engine. During engine motoring, operate controls applicable to system in which pump was replaced, as follows (Ref. 71-00-00):

System A, operate flaps (1 cycle)

System B, operate B-A PTU and flaps (1 cycle)

System C, operate flaps (1 cycle)

System D, on PFCS panel, position AILERON switchlights to on (OFF lights out) and operate roll control wheel (5 cycles)

(c) Release flight control switchlights which were depressed in Step 4A(4)(a).

(5) On the HYDRAULIC SYSTEM panel, zone 215, observe that the applicable PUMP OUTLET LO PR indicator light goes out within 1 minute.

NOTE: If indicator light does not go out, verify that the firewall shutoff valve is open and pump suction, pressure, and case drain hoses are connected.

(6) Stop engine motoring (Ref. 71-00-00).

(7) Check all hydraulic pump lines at pump and filter assembly for evidence of leakage after initial operation of pump.

(8) Perform reservoir AIR CHECK and reservoir AIR BLEED in accordance with instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placards, zone 147.

(9) Turn off electrical power (Ref. 24-41-00).

(10) Close and lock cowl panels.

(11) Close and lock hydraulic service center access doors.

ELECTRIC MOTOR-DRIVEN HYDRAULIC PUMP - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container

Protective caps and plugs, LS12994-6,-10, and -18, or equivalent

Packing (O-ring), NAS1612-6,-8,-10, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

2. Referenced Procedures

	12-13-01	Hydraulic Fluid Replenishing
	24-41-00	External Power/Ground Service System - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices
	29-11-08	Electric Motor-driven Hydraulic Pump - Adjustment and Test

3. Removal/Installation

A. Removal

NOTE: When an ac electric motor-driven pump is being replaced due to malfunction, and internal damage is suspected, the affected system pressure, case drain, and return line filters must be removed and inspected for indications of metal particle contamination. The applicable system must be flushed if contamination is detected.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker AC PUMP B3 or C3, as applicable.

(2) Open service center access doors 147AB and 147BB.

NOTE: The electric motor-driven pumps are mounted on the left and right sidewalls below and aft of systems B and C reservoirs. Removal and installation procedures are identical for the B3 or C3 pump.

(3) Disconnect electrical connector from pump (Ref. Fig. 401).

R R R R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF. 29-11-00,201).

CAUTION: USE EXTREME CARE TO PREVENT DAMAGE TO HOSES FROM BENDING OR KINKING DURING PUMP REMOVAL. DO NOT SUPPORT THE WEIGHT OF THE ATTACHED COMPONENT FROM THE HOSES.

(4) Before continuing verify that affected hydraulic system is depressurized (Ref. 29-11-00).

(5) Disconnect hydraulic connectors from pump fittings. Remove fittings for installation in replacement pump. Discard packings.

(6) Install protective caps and plugs on all exposed connectors and ports.

(7) Remove mounting bolts and remove pump.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged, and check that:

(a) Pump ports are clean

(b) Adapter fittings are installed with new packings lubricated with hydraulic fluid

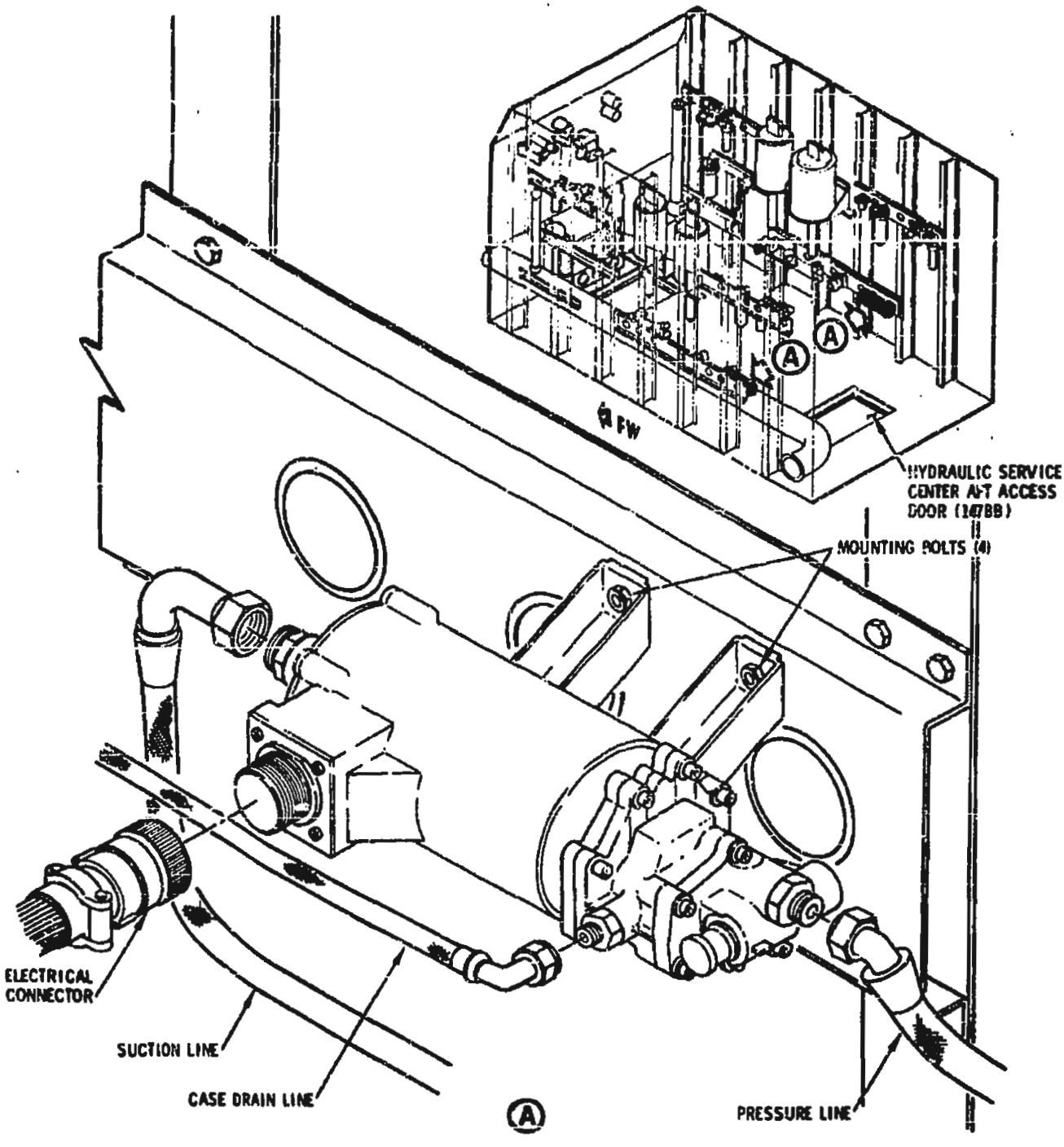
(c) Pump case is filled with hydraulic fluid

(2) Position pump in place and install mounting bolts.

CAUTION: PUMP SUCTION LINE MUST BE FULL OF HYDRAULIC FLUID AND FREE OF AIR TO PREVENT PUMP CAVITATION DURING PUMP START.

USE EXTREME CARE TO PREVENT BENDING, KINKING OR INTRODUCING A TWISTING PRELOAD IN THE HOSE WHEN TIGHTENING FITTINGS.

(3) Remove protective plugs and caps from pump suction, pressure, and case drain lines; fill lines with clean hydraulic fluid and connect lines to pump adapter fittings.



R Electric Motor-driven Hydraulic Pump - Removal and Installation
R Figure 401

(4) Connect electrical connector.

(5) Remove tag and close circuit breaker opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on electrical power (Ref. 24-41-00).

(7) Replenish hydraulic fluid level in reservoir (Ref. 12-13-01).

(8) Pressurize and bleed applicable system as follows:

(a) On pilots overhead PFCS panel, position all servos except system A to OFF.

(b) Turn on B3 AC MOTOR PUMP and B-A PTU.

NOTE: If system pressure does not build up when pump is turned on, additional bleeding at the pump suction supply hose may be required.

(c) Turn on C3 AC MOTOR PUMP.

(d) Operate flaps through one cycle.

(9) Perform reservoir AIR BLEED, AIR CHECK and FLUID QUANTITY CHECK in accordance with RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(10) Test pump operation (Ref. 29-11-08).

(11) Turn off electrical power (Ref. 24-41-00).

(12) Close and lock hydraulic service center access doors.

ELECTRIC MOTOR-DRIVEN HYDRAULIC PUMP ADJUSTMENT AND TEST

1. General

The following operational test verifies the control and operation of the AC motor-driven Hydraulic Pumps from the Flight Engineers HYDRAULIC SYSTEM panel, zone 215, and from the HYDRAULIC SERVICE PANEL, zone 147.

2. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Hydraulic Service Cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

3. Referenced Procedures

12-13-01 Hydraulic Fluid Replenishing

R 24-00-00 Electrical Power - Maintenance Practices

4. Adjustment/Test

A. Operational Test

(1) Install RAT safety bar if RAT is in stowed position.

(2) On the pilots overhead circuit breaker panel CB1, zone 210, verify that the LANDING GEAR - PROX SW PWR - NO. 1 and NO. 4 (L10, 11) circuit breakers are closed.

On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

IND LT - F/E PANEL UPPER (J3)

GROUND SERVICE - AC HYD MOTOR IND (L10)

HYDRAULIC

AC PUMP B3 and C3 (L12, 22)

INDICATORS - QTY and PRESS (M12, 13)

On the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that PROXIMITY SWITCH 2 and 3 (H3, 4) circuit breaker are closed.

(3) Verify that the applicable system reservoir fluid level is in SAFE LEVEL as indicated on the HYDRAULIC SERVICE PANEL, zone 147.

(4) Perform AIR CHECK and AIR BLEED in accordance with RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) On the pilots overhead PFCS panel, position all flight control servos to OFF or INOP.

R (6) Turn on electrical power (Ref. 24-00-00).

(7) Check AC PUMPS control from Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, as follows:

NOTE: Acceptable B and C system A.C. Pump hydraulic pressure, with all servo valves off and PTUs off (no flow demand) is a minimum of 3000 psig.

(a) Depress B3 AC PUMP switchlight; verify that the ON light comes on and B system pressure indicator reads 3000 psig minimum.

(b) Release B3 AC PUMP switchlight; verify that the ON light goes out and B system pressure goes to zero.

(c) Depress C3 AC PUMP switchlight; verify that the ON light comes on and C system pressure indicator reads 3000 psig minimum.

(d) Release C3 AC PUMP switchlight; verify that the ON light goes out and C system pressure goes to zero.

(e) Depress B3 and C3 AC PUMP switchlights and verify that both ON lights come on and B and C system pressure indicators read 3000 psig minimum.

(f) Release B3 and C3 AC PUMP switchlights and verify that both ON lights go out and both B and C system pressure indicators go to zero.

(8) Open hydraulic service access doors and check A.C. MOTOR PUMP control from HYDRAULIC SERVICE PANEL as follows:

(a) Lift switch guard and position B SYS A.C. MOTOR PUMPS toggle switch to ON; verify that pump operates and B SYS PRESSURE gage indicates 3000 psig minimum.

(b) Position B SYS toggle switch to OFF; verify that pump stops and pressure decays to zero.

(c) Lift switchguard and position C SYS A.C. MOTOR PUMPS toggle switch to ON; verify that pump operates and C SYS PRESSURE gage indicates 3000 psig minimum.

(d) Position C SYS toggle switch to OFF; verify that pump stops and pressure decays to zero.

(9) Check hydraulic service center access door interlock as follows:

(a) Lift switchguards and position B SYS and C SYS A.C. MOTOR PUMPS toggle switches to ON; verify that both pumps operate.

(b) Temporarily close the forward hydraulic service center access door; verify that both B SYS and C SYS pumps stop and the toggle switches go to OFF position.

(c) Reopen forward access door.

(d) Repeat Step (9)(a).

(e) Position B SYS and C SYS toggle switches to OFF; verify that both pumps stop.

(10) Turn off electrical power (Ref. 24-00-00).

(11) Close and lock hydraulic service center access doors.

R B. Magnetic Circuit Breaker Protection Circuit Validation Test

(1) Turn off electrical power (Ref. 24-00-00).

(2) Remove wire 2911-20064A8C from Terminal C2 of 2911-CB19, B3 AC Pump RCCB (Ref. Fig. 501).

(3) Remove wire 2911-30064A8C from Terminal C2 of 2911-CB20, C3 AC Pump RCCB.

(4) Turn on electrical power (Ref. 24-00-00).

(5) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, depress B3 and C3 AC PUMP switchlights. Verify switchlight ON legends remain off and AC hydraulic pumps do not operate.

(6) Verify both B3 and C3 Magnetic Circuit Breakers on the Magnetic Circuit Breaker panel (MCBP) trip to the OFF position.

(7) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, release B3 and C3 AC PUMP switchlights.

(8) Turn off electrical power (Ref. 24-00-00).

(9) Reconnect wires removed from B3 and C3 RCCBs in Steps 4B(2) and (3).

(10) Reset both magnetic circuit breakers on the MCBP to the ON (up) position.

(11) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

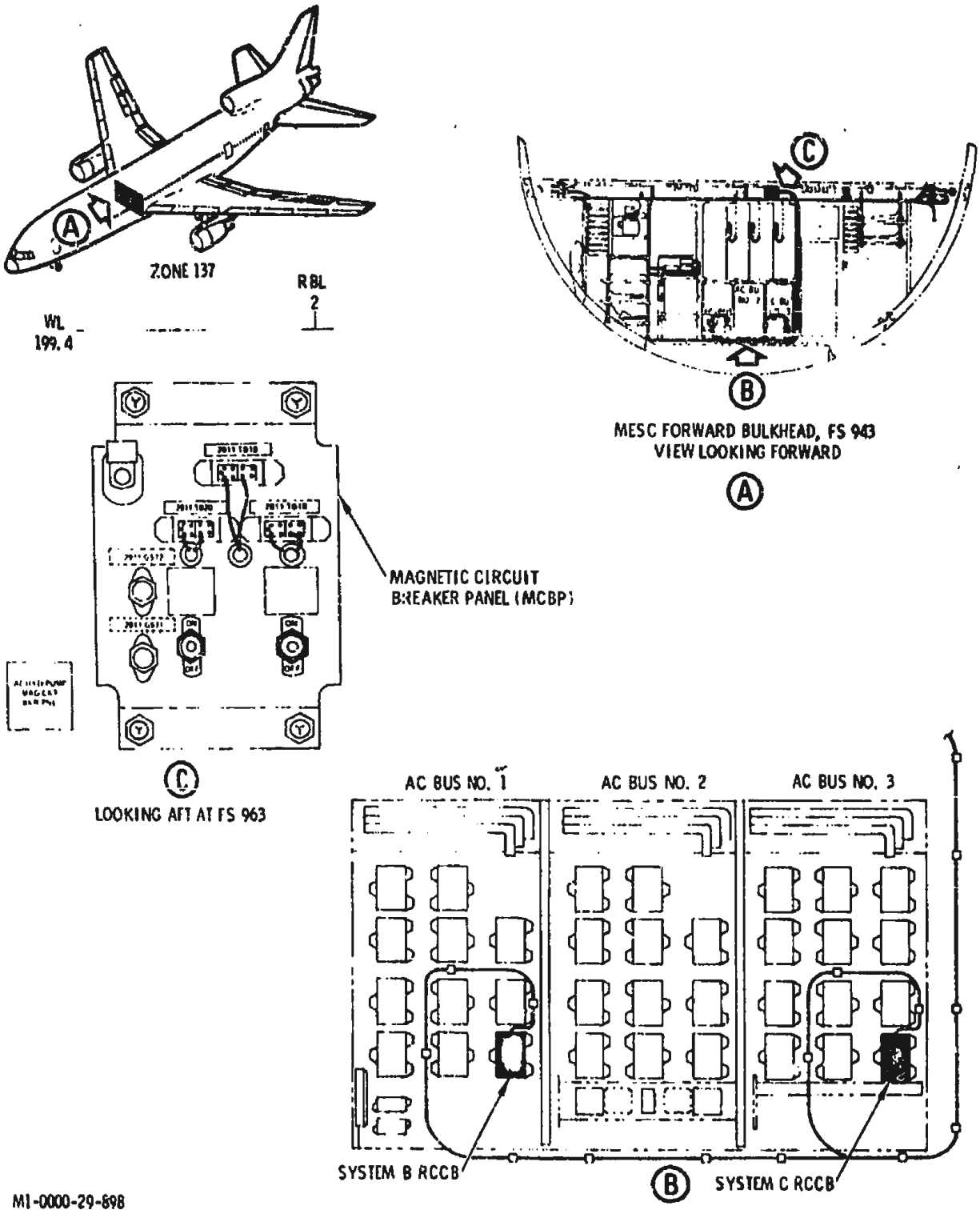
TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(12) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, depress B3 and C3 AC PUMP switchlights. Verify the switchlight ON legends come on and the B3 and C3 AC Hydraulic Pumps in the hydraulic service center are operating.

(13) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, release B3 and C3 AC PUMP switchlights. Verify the switchlight ON legends go off and the B3 and C3 AC Hydraulic Pumps stop operating.

(14) Turn off electrical power (Ref. 24-00-00).



Protection Circuit Validation Test
Figure 501

HIGH-PRESSURE FILTER MODULE ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3-gallon)

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

R Hydraulic Service cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

Protective plugs and caps

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers (delta) P & RSVR TEMP IND (L9) and ATM PUMPS CONT and IND for system B or C (L13, 19), as applicable, and INDICATORS PRESS (M12, 13).

(2) Open hydraulic service center access doors 147AB and 147BB.

NOTE: The high-pressure filter module assemblies, one for each system (A, B, C, and D), are installed and located on the left and right sidewalls next to the hydraulic reservoirs (Ref. Fig. 401). Removal and installation procedures are essentially identical for each filter module.

(3) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and HYDRAULIC SERVICE PANEL, zone 147, tag applicable hydraulic system controls to prevent

pressurization of the system during filter module removal and installation.

(4) Disconnect electrical connectors from differential-pressure switch, pressure transmitter, and low-pressure caution switch (systems B and C only).

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING
R ANY HYDRAULIC LINES. VERIFY ZERO PSI AT
R RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE
R PANEL (REF. 29-11-00,201).

(5) Position container to catch fluid drainage, and disconnect all hydraulic lines to filter module.

(6) Remove mounting bolts and remove filter module.

(7) Place protective caps and plugs on all fittings and ports.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged, and that switches tagged in Step 3A(3) are as required.

(2) Place filter module in position and install mounting bolts.

(3) Remove protective plugs and caps, connect and tighten all hydraulic lines to filter module.

(4) Connect electrical connectors to filter differential-pressure switch, pressure transmitter, and low-pressure caution switches (systems B and C only).

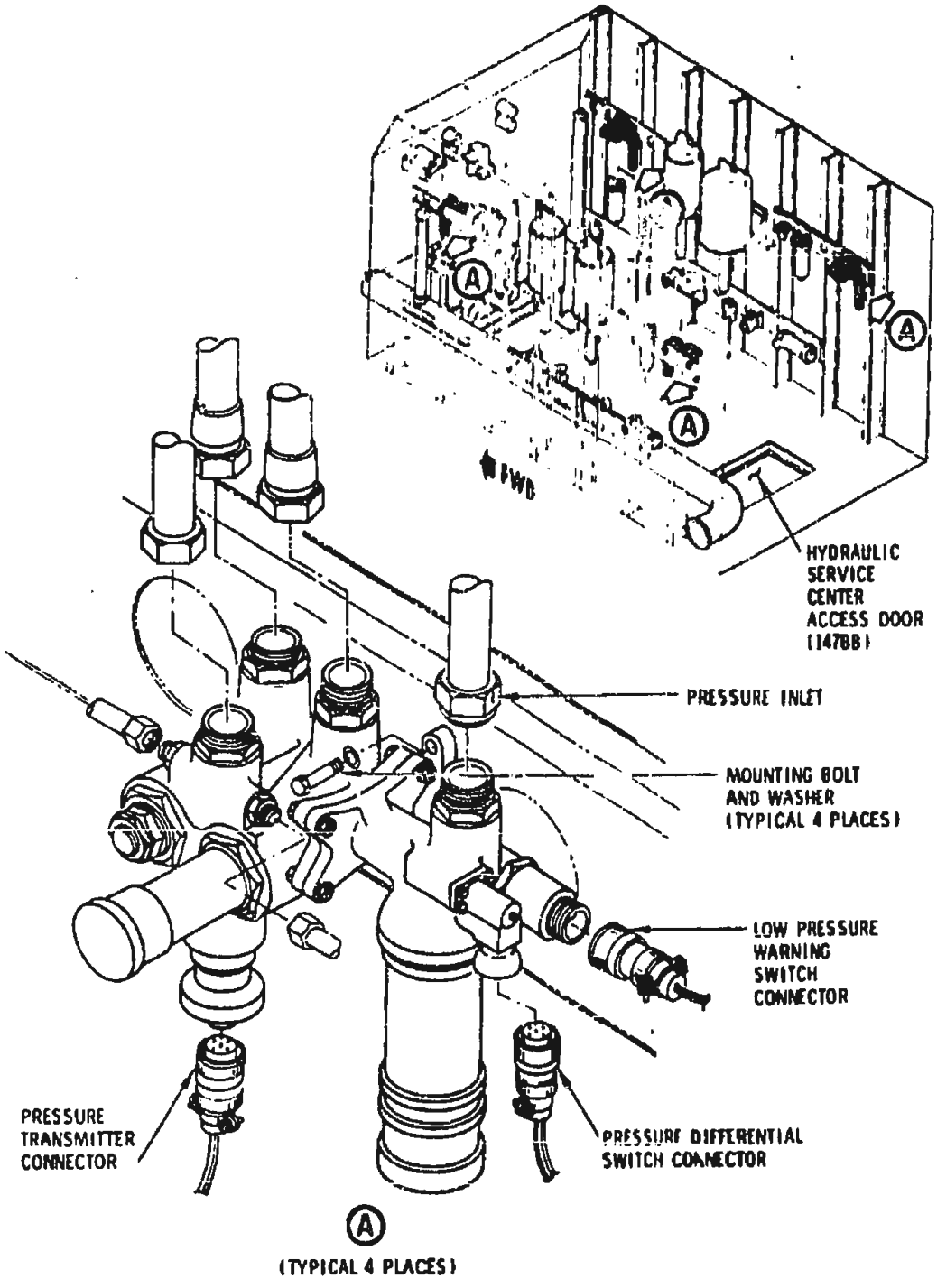
(5) Remove tags and close circuit breakers opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.



HA 0407
M1 0100-29-148

R High-pressure Filter Module - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL

R
050B

(6) Turn on electrical power (Ref. 24-41-00).

(7) Remove tags installed in Step 3A(3) and pressurize applicable hydraulic system (Ref. 29-11-00).

(8) Check reservoir fluid level and bleed applicable system as follows:

(a) On pilots overhead PFCS panel, position all except SPOILER L & R2 switchlights to OFF or INOP.

(b) Turn on B3 and C3 AC pumps.

(c) For systems A, B, and C: turn on B-A PTU and operate flaps (1 cycle).

(d) For system D: turn on C-D PTU and operate speed brake (spoilers) through 15 cycles.

(e) Shut off PTU and AC pumps.

(f) Release servo switchlights depressed in Step (a).

(9) Check filter housing for leakage.

(10) Perform reservoir AIR BLEED, AIR CHECK and FLUID QUANTITY CHECK on the applicable hydraulic reservoir in accordance with instructions on RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(11) Turn off electrical power (Ref. 24-41-00).

(12) Close and lock hydraulic service center access doors.

HIGH-PRESSURE FILTER HOUSING ASSEMBLY REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3-gallon)

Hydraulic Fluid, LAC Spec C-34-1224 or equivalent

Hydraulic Service Dolly (Ref. 12-13-03), or equivalent

Protective plug, LS 12995-16, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

R	12-13-01	Hydraulic Fluid Replenishing
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers (delta) P & RSVR TEMP IND (L19) and ATM PUMPS CONT and IND (L13, L19) for system B or C, as applicable.

(2) Open hydraulic service center access doors 147AB and 147BB.

NOTE: The high-pressure filter housing assemblies are installed, one each, in the high pressure filter modules located on the left and right sidewalls next to the hydraulic reservoirs (Ref. Fig. 401). Removal and installation procedures are essentially identical for each filter housing.

(3) Tag the applicable hydraulic system controls on the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147, to

prevent pressurization of the system during the filter housing removal and installation.

(4) Disconnect electrical connectors from differential pressure switch and low-pressure caution switch (system B and C only).

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
R HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR
R PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF.
R 29-11-00, 201).

(5) Position container to catch fluid drainage and disconnect pressure inlet fitting from top of filter housing.

(6) Remove nuts, bolts, and washers from filter housing mounting flange and remove filter housing from module.

(7) Cap pressure line fitting and cover module opening to protect against contamination.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged and check that:

(a) High-pressure filter module plug-in cavity is clean

(b) Packings (O-rings) and backup rings are properly placed on plug-in portion of filter housing (lubricated with hydraulic fluid)

(2) Install plug-in filter unit into module.

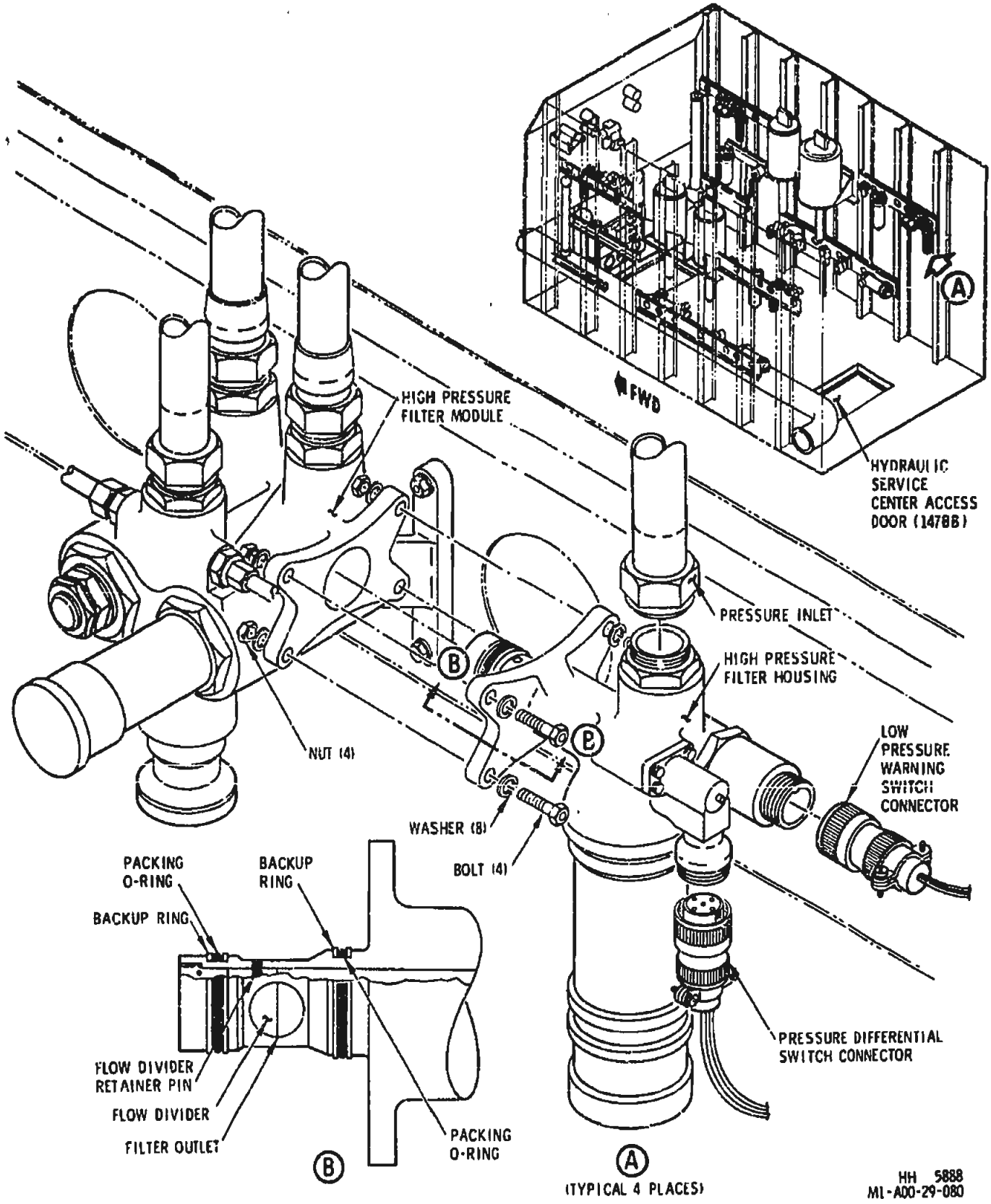
(3) Install bolts with washers under bolt heads and nuts.

(4) Remove protective plugs and connect and tighten pressure line fitting to inlet adapter on top of filter housing.

(5) Connect electrical connectors to filter differential pressure switch and low-pressure caution switch (system B or C only).

(6) Remove tags and close circuit breakers opened in Step 3A(1).

(7) Check that filter housing assembly contains a filter element, fill filter bowl with hydraulic fluid, reinstall bowl, and lock-wire.



High-pressure Filter Housing Assembly
Removal and Installation
Figure 401

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on electrical power (Ref. 24-41-00).

(9) Remove tags and pressurize system applicable hydraulic system (Ref. 29-11-00).

R (10) Check reservoir fluid level and bleed system as
R follows:

R (a) On pilots overhead PFCS panel position all flight
R control servos, except SPOILER L & R2 to OFF or
R INOP.

R (b) Turn on B3 and C3 AC pumps.

R (c) For systems A, B, & C turn on B-A PTU and operate
R flaps through 1 cycle.

R (d) For system D turn on C-D PTU and operate speed
R brake (spoilers) through 15 cycles.

R (e) Turn off AC pumps and PTU, as required.

R (f) Release switchlights depressed in Step (a).

R (11) Check filter housing for leakage.

R (12) Perform applicable reservoir AIR BLEED, AIR CHECK, and
R FLUID QUANTITY CHECK in accordance with RESERVOIR
R SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

R (13) Turn off electrical power (Ref. 24-41-00).

R (14) Close and lock hydraulic service center access doors
R 147AB and 147BB.

HIGH-PRESSURE FILTER HOUSING ASSEMBLY (ENGINE-DRIVEN PUMPS) REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3-gallon)

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Hydraulic Service Cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

Protective plugs and caps

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Removable Panels
	12-13-01	Hydraulic Fluid Replenishing
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices
	71-00-00	Power Plant - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers as follows:

FUEL SHUTOFF VALVE

R TANK ENG 1 (D10)

R TANK ENG 2 (D11)

R TANK ENG 3 (D12)

R PRI EMER 2 (D14)

FIRE EXTINGUISHER

R ENG 1 MAIN (C10)

R ENG 1 ALTN (C11)

R ENG 2 MAIN (C12)

R ENG 2 ALTN (C13)

R ENG 3 MAIN (C14)

R ENG 3 ALTN (C15)

R On aircraft 028, 029,

R ECS SCHEDULE

R ENG 1 (H8)

R ENG 3 (H9)

R On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, open and tag circuit
R breakers as follows:

R GROUND SERVICE

R (delta) P & RSVR TEMP IND (L9)

R HYDRAULIC

R QTY-TEMP-PRESS IND LT

R SYS A PUMP (M15)

R SYS B PUMP (M17)

R SYS C PUMP (M19)

R SYS D PUMP (M21)

On Flight Engineer/Second Officers overhead circuit breaker panel CB3, zone 215, open and tag circuit breakers as follows:

FUEL SYSTEM

ENG 1 - EMER & L X FEED (T7)

ENG 2 - SEC EMER C X FEED (T10)

ENG 3 - EMER & R X FEED (T13)

(2) On pilots overhead circuit breaker panel CB1, zone 215, verify that applicable circuit breaker HYD PUMP FIREWALL SHUTOFF VALVE CONT (L15-L18) is closed.

(3) Open hydraulic service center access doors 147AB and
R 147BB (Ref. 6-40-00).

NOTE: Removal and installation procedures are essentially identical for each high-pressure filter housing assembly.

(4) Close and tag applicable firewall shutoff valve (FIRE-PULL handle).

(5) Open and tag applicable circuit breaker HYD PUMP FIREWALL SHUTOFF VALVE CONT (L15-L18).

(6) On the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147, tag applicable hydraulic system controls to prevent pressurization of the system during the filter housing removal and installation.

(7) Open access panels for the applicable filter housings as follows:

(a) Systems A and D: open panel 453DR or 453DL, respectively, on left and right pylons.

(b) Systems B and C: open left and right lower hinged cowl panels, zone 317.

(8) Disconnect electrical connectors from the filter
R housing (Ref. Fig. 401).

WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR
R PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF.
R 29-11-00).

(9) Position container to catch fluid drainage, and disconnect all hydraulic lines to filter housing assembly.

(10) Remove mounting bolts and remove filter housing assembly.

(11) Install protective caps and plugs on all open fittings and ports.

R B. Installation

R R R (1) Verify that circuit breakers opened in Step 3A(1) and 3A(5) are open and tagged, and that switches tagged in Step 3A(6) are as required.

R R (2) Place filter housing assembly in position and install mounting bolts (Ref. Fig. 401).

(3) Remove protective plugs and caps.

(4) Connect hydraulic lines to filter housing assembly.

(5) Connect electrical connectors to filter housing.

(6) Remove tags and close circuit breakers opened in Step 3A(5).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on electrical power (Ref. 24-41-00).

(8) Open applicable firewall shutoff valve (FIRE-PULL handle).

(9) Remove tags installed in Step 3A(6), and pressurize applicable hydraulic system using AC PUMPS and PTU as required (Ref. 29-11-00) and bleed the system as follows:

(a) On the pilots overhead panel, position the PFCS panel RUDDER, STABILIZER, AILERON, and SPOILER switchlights to OFF or INOP.

(b) Motor the applicable engine (Ref. 71-00-00). During engine motoring, operate controls applicable to system involved as follows:

System A: operate flaps (1 cycle)

System B: operate B-A PTU and flaps (1 cycle)

System C: operate flaps (1 cycle)

System D: on PFCS panel, position AILERON switchlight to ON (OFF lights out) and operate control wheel (5 cycles)

(c) Release flight control switchlights which were depressed in Step B9(a).

(d) Stop engine motoring (Ref. 71-00-00).

(10) Check all fittings for leakage after first engine run or engine motoring.

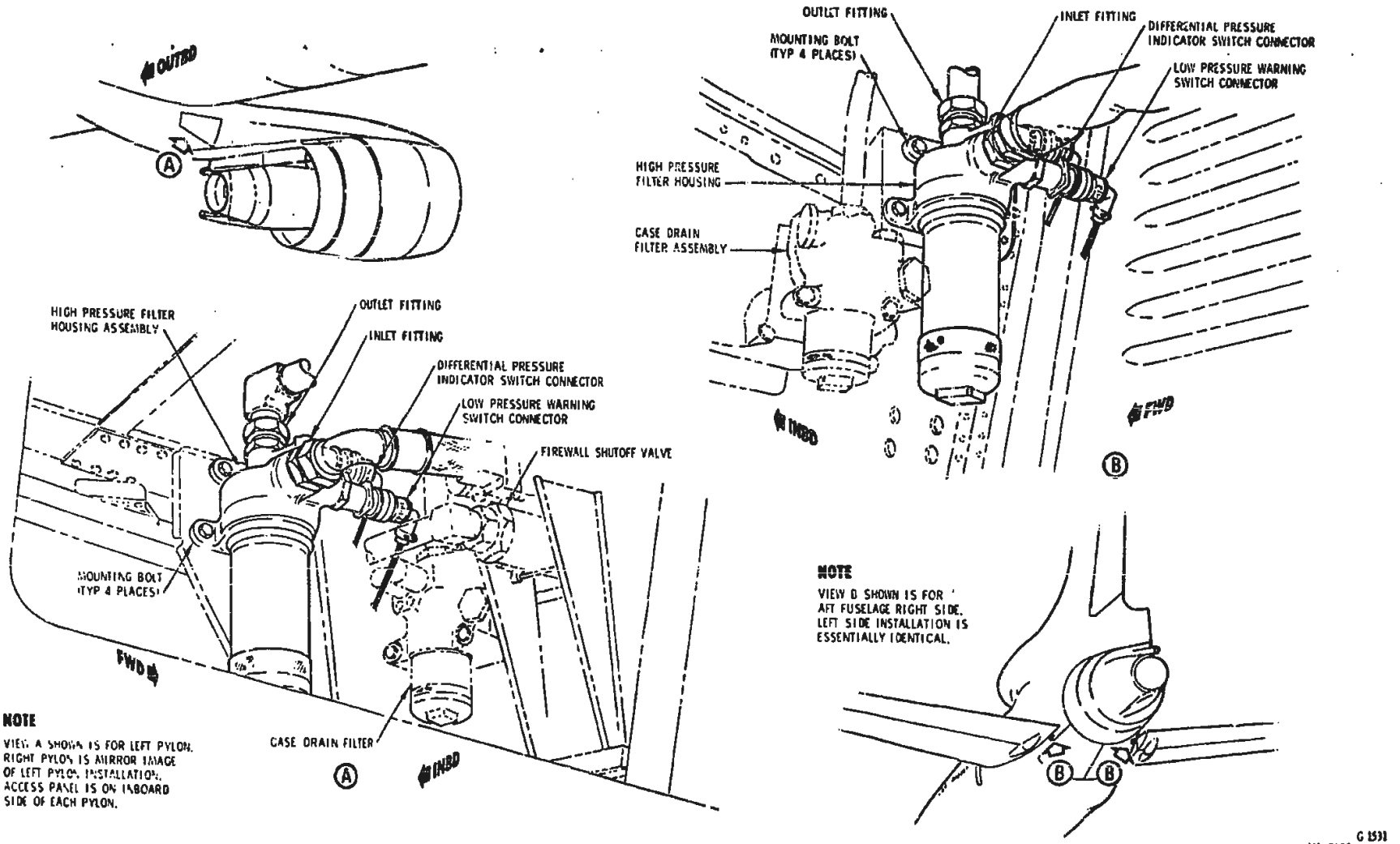
NOTE: The engine-driven pump high-pressure filters can only be pressurized by operation of the engine-driven pumps due to check valve locations.

(11) Perform hydraulic reservoir AIR BLEED and AIR CHECK of system affected by filter assembly replacement, and replenish the reservoir in accordance with on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(12) Turn off electrical power if no longer required (Ref. 24-41-00).

(13) Reinstall access panels opened or removed in Step 3A(7).

(14) Close and lock hydraulic service center access doors (Ref. 6-40-00).



High-pressure Filter Housing Assembly (Engine-driven Pumps)
Removal and Installation
Figure 401

R
R
0018 EFFECTIVITY: ALL

HIGH-PRESSURE FILTER ELEMENT - REMOVAL AND INSTALLATION

1. General

Removal and installation procedures for all the high-pressure filter elements are essentially identical. Filter locations and access panel identifications are as follows:

High-pressure (Engine-dr) Sys A left pylon - 453DR

High-pressure (Engine-dr) Sys D right pylon - 463DL

High-pressure (Engine-dr) Sys B & C aft fuslg - L & R lower hinged cowl panels

High-pressure (Module) Sys A and D (PTU) Sys B and C (ATM) - Hydraulic service center

2. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Fluid container (3-gallon)

R Hydraulic Service Cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

3. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

(1) Open hydraulic service center access doors 147AB and 147BB.

R R R R WARNING: ENSURE THAT THE APPLICABLE HYDRAULIC SYSTEM IS SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147. DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

(2) Gain access to the applicable filter assembly (Ref. Para. 1).

(3) Loosen filter bowl and remove from filter housing (Ref. Fig. 401).

(4) Empty fluid from bowl into fluid container; remove and discard filter element.

B. Installation

(1) Clean filter bowl and filter element cavity in filter housing.

NOTE: Filter housing disassembly and cleaning are required following engine-driven pump failure (Ref. 29-11-07).

(2) Inspect filter assembly packing (O-rings) and backup rings as follows:

(a) Verify that new filter element contains O-ring and backup rings (2).

(b) Carefully inspect bowl seal packing O-ring and backup rings. Replace if damage is suspected.

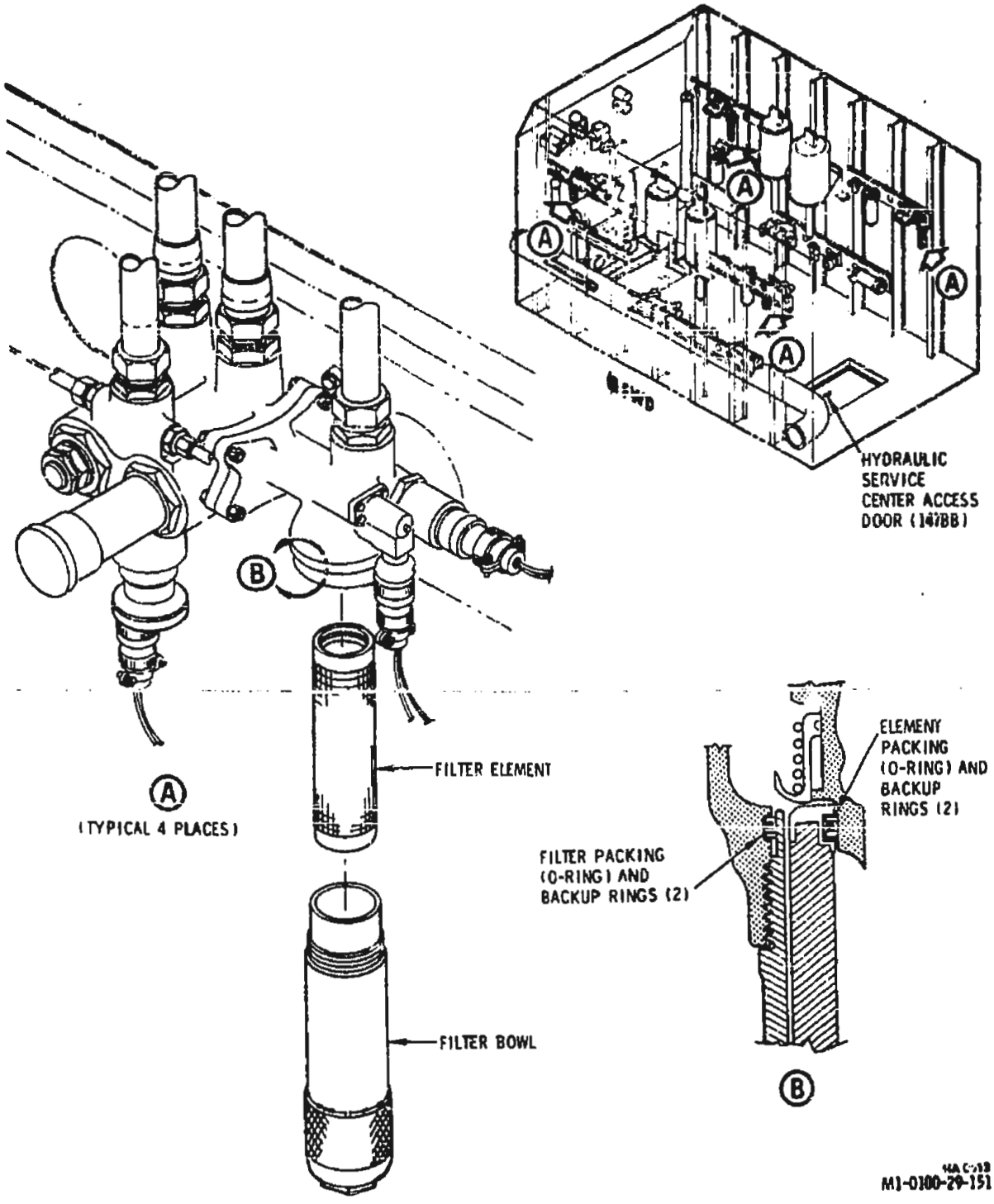
NOTE: The inlet shutoff valve must be displaced upward to gain access to the seals.

(c) Lubricate bowl threads, housing and filter element seals with hydraulic fluid before installation.

(3) Install element in filter housing.

(4) Fill bowl assembly with clean hydraulic fluid. Install filter bowl into module; verify that filter housing head overlaps the filter bowl flange to confirm full insertion. Torque 15 to 20 lb ft and lock-wire.

NOTE: If any unusual resistance or binding is encountered before bottoming and final torque, remove bowl and reinspect seals for damage.



R High-pressure Filter Element - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
050B

(5) Reset differential-pressure (clogged filter) caution switch button, if switch was actuated.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on electrical power (Ref. 24-41-00).

(7) Remove tags and pressurize applicable hydraulic system (Ref. 29-11-00).

(8) Check filter bowl installation for leakage.

(9) Verify that clogged filter caution indicator light is out.

(10) Check fluid level in applicable system reservoir affected by filter element replacement and replenish as required in accordance with placarded instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(11) Turn off electrical power (Ref. 24-41-00).

(12) Close access panels opened for access to filter assembly.

(13) Close and lock hydraulic service center doors.

RETURN FILTER MODULE ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3-gallon)

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

R Hydraulic Service Cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

Protective plugs and caps

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker (delta) P & RSVR TEMP IND.

(2) Open hydraulic service center access doors 147AB and 147BB.

NOTE: The return filter module assemblies, one for each system (A, B, C, and D), are installed and located on the left and right sidewalls next to the hydraulic reservoirs (Ref. Fig. 401). Removal and installation procedures are essentially identical for each filter housing.

(3) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and HYDRAULIC SERVICE PANEL, zone 147, tag applicable hydraulic system controls to prevent pressurization of the system during filter module removal and installation.

(4) Disconnect electrical connector from differential-pressure switch.

R R R R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR PRESSURE GAGE ON GYDRAULIC SERVICE PANEL (REF. 29-11-00,201).

(5) Position container to catch fluid drainage, and disconnect all hydraulic lines to filter module.

(6) Remove mounting bolts and remove filter module.

(7) Install protective caps and plugs on all fittings and ports.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged and that switches tagged in Step 3A(3) are as required.

(2) Place filter module in position and install mounting bolts.

(3) Remove protective plugs and caps and connect hydraulic lines to filter module.

(4) Ensure filter bowl is fully installed as indicated by no threads showing on top of bowl.

(5) Connect electrical connector to differential-pressure switch.

(6) Remove tag and close circuit breaker opened in Step 3A(1).

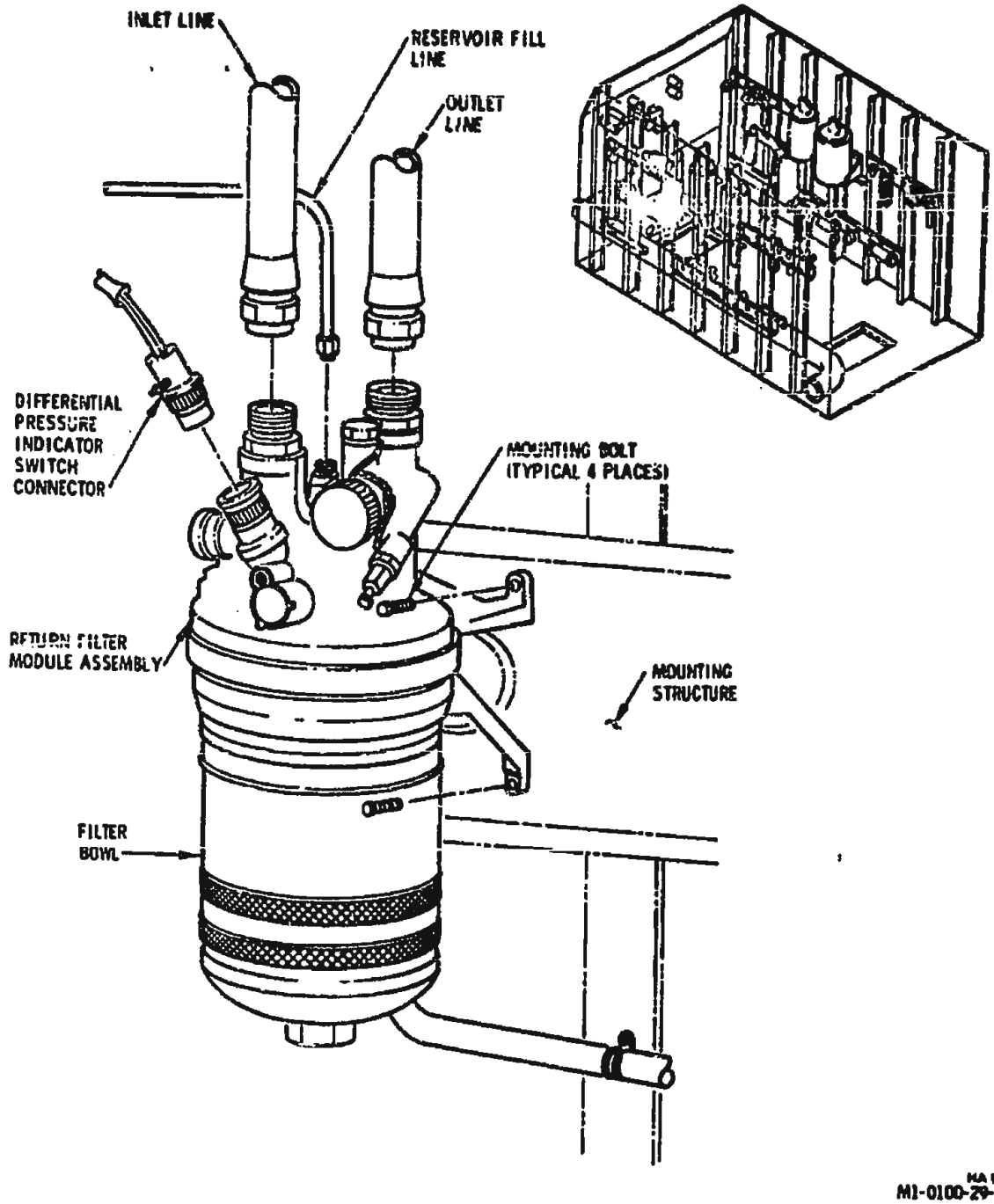
R R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on electrical power (Ref. 24-41-00).



R Return Filter Module Assembly - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
050B

(8) Remove tags installed in Step 3A(3) and pressurize applicable hydraulic system (Ref. 29-11-00).

(9) Operate stabilizer at moderate rate (2 cycles).

(10) Check filter housing for leakage.

(11) Bleed and replenish hydraulic reservoir in accordance with placarded instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(12) Turn off electrical power (Ref. 24-41-00).

(13) Close and lock hydraulic service center access doors.

RETURN FILTER ELEMENT - REMOVAL AND INSTALLATION

1. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Fluid Container (3-gallon)

Hydraulic Service Cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal and Installation

A. Removal

WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

(1) Open hydraulic service center access doors 147AB and 147BB and verify that applicable hydraulic system is depressurized.

(2) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and HYDRAULIC SERVICE PANEL, zone 147, tag applicable hydraulic system control to prevent pressurization of system during filter element removal and installation.

R CAUTION: TO ROTATE THE BOWL, USE A STRAP WRENCH ON THE BODY OR A SOCKET WRENCH ON THE HEXAGON. DO NOT USE AN OPEN-END WRENCH.

(3) Gain access to applicable filter module assembly, place fluid container under module and remove filter bowl (Ref. Fig. 401).

C C C C C C C C C C C NOTE: A pending Airworthiness Directive (AD) requires removal of the hydraulic system return filter shutoff valves (See Maintenance Manual, 29-11-22, Fig. 401, Detail B). This valve is open by installation of the filter bowl and element and closes to block fluid drainage when the bowl and element are removed. Consequently, when elements are replaced in the future, inlet fluid will continue to drain until fluid in the line is depleted.

NOTE: On aircraft with SB29-069 use a fluid container of at least one gallon capacity.

(4) Empty fluid from bowl/assembly into fluid container and CR remove filter elementfrom filter bowl.

B. Installation

(1) Clean filter bowl and filter element cavity.

(2) Install filter bowl O-ring and verify that filter element contains O-ring. Lubricate O-rings and bowl threads with hydraulic fluid before installation.

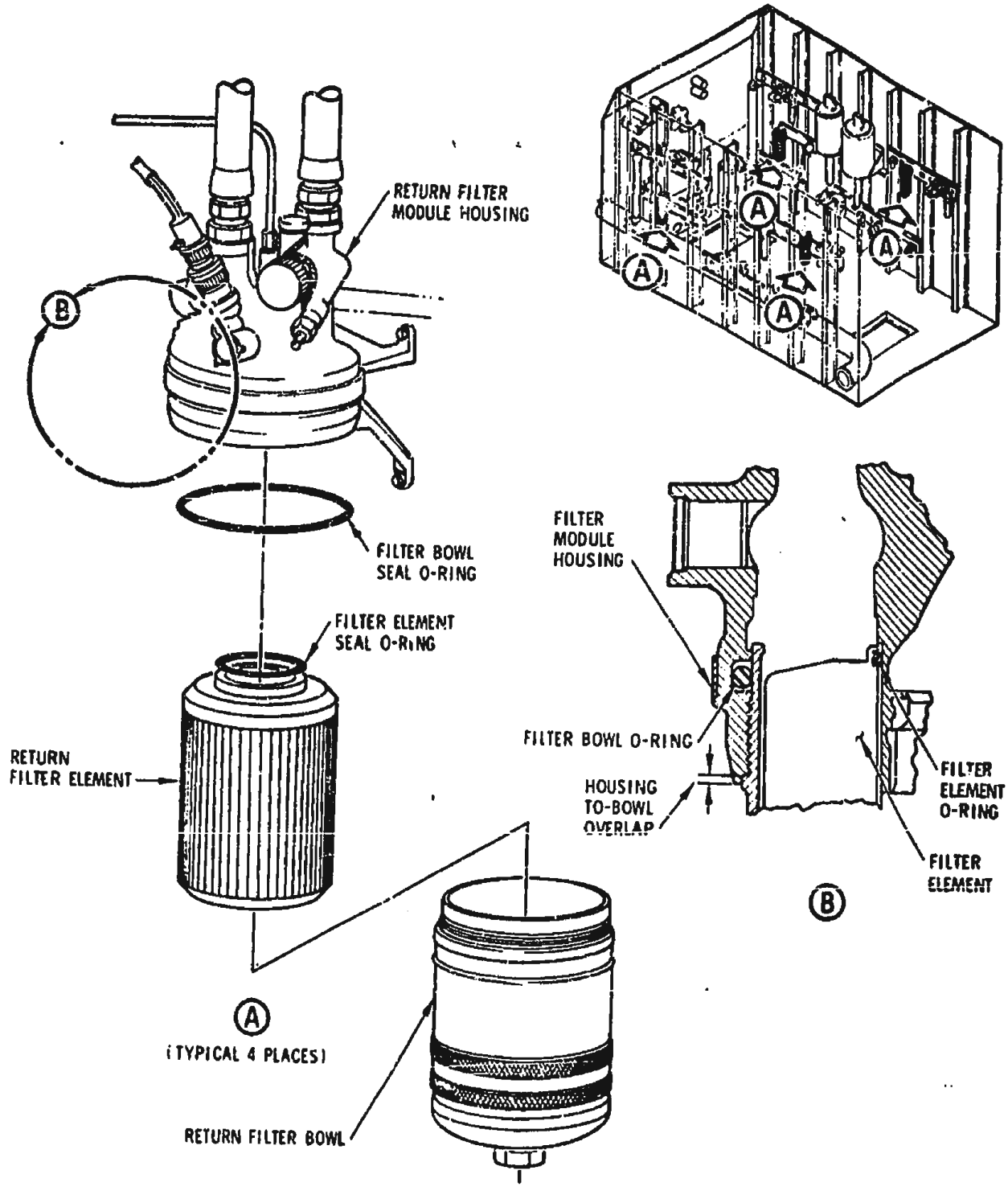
CR (3) Install element in filter bowl(Ref. Figure 401).

CAUTION: AFTER INSTALLATION, VERIFY THAT FILTER BOWL IS FULLY INSERTED INTO FILTER HOUSING BY OBSERVING THAT THE HOUSING FLANGE OVERLAPS THE BOWL FLANGE AND NO THREADS ARE VISIBLE.

TO ROTATE THE BOWL, USE A STRAP WRENCH ON THE BODY, OR A SOCKET WRENCH ON THE HEXAGON. DO NOT USE AN OPEN-END WRENCH.

(4) Fill filter bowl with clean hydraulic fluid. Install filter bowl into filter housing. Torque 40 to 60 lb ft and lock-wire.

(5) Reset differential-pressure indicator switch button, if switch was actuated.



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CR Return Filter Element - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL

001B

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on electrical power (Ref. 24-41-00).

(7) Remove tags installed in Step 3A(2) and pressurize applicable hydraulic system (Ref. 29-11-00).

(8) Check filter bowl installation for leakage.

(9) Verify that applicable clogged filter caution light on HYDRAULIC SERVICE PANEL, zone 147, is out.

(10) Check fluid level in applicable system reservoir affected by filter element replacement, and replenish as required in accordance with placarded instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(11) Turn off electrical power (Ref. 24-41-00).

(12) Close and lock hydraulic service center access doors.

CASE DRAIN FILTER MODULE ASSEMBLY - REMOVAL AND INSTALLATION

1. General

Removal and installation procedures for all case drain filter modules are identical except for filter locations and access panel identifications which are as follows:

Primary systems (engine-driven pumps) for systems A and D in left and right pylons, zones 453 and 463: access panels 453DR and 463DL, respectively. Systems B and C in aft fuselage, zone 317: left and right lower hinged cowl panels.

ATM-driven pumps for systems B and C in hydraulic service center, zone 147: aft left and right sidewalls.

PTU pump section for systems A and D in hydraulic service center, zone 147: forward left and right sidewalls.

PTU motor section and electric motor pump (dual bowl) for systems B and C in hydraulic service center, zone 147: lower left and right sidewalls (near PTU).

2. Equipment and Materials

Fluid container (3-gallon)

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

R Hydraulic Service Cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

Protective plugs and caps

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

3. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers (delta) P & RSVR TEMP IND (L9) and HYDRAULIC QTY-TEMP-PRESS IND LTS SYS A, B, C, or D PUMP (M15, 17, 19, 21), as applicable.

(2) Open hydraulic service center access doors 147AB and 147BB.

(3) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and HYDRAULIC SERVICE PANEL, zone 147, tag applicable hydraulic system controls to prevent pressurization of system during filter module removal and installation.

(4) Disconnect electrical connectors from differential-pressure switch and thermal caution switch (Ref. Fig. 401).

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
R HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR
R PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF.
R 29-11-00,201).

(5) Position container to catch fluid drainage, and disconnect all hydraulic lines to filter module.

(6) Remove mounting bolts and remove filter module.

(7) Install protective caps and plugs on all open fittings and ports.

B. Installation

(1) Verify that circuit breakers opened in Step 4A(1) are open and tagged.

(2) Verify that switches tagged in Step 4A(3) are in OFF position.

(3) Place filter module in position and install mounting bolts.

(4) Remove protective plugs and caps.

CAUTION: ON ENGINE-DRIVEN PUMP CASE DRAIN FILTER MODULE INSTALLATIONS USE EXTREME CAUTION TO CONNECT FLEX HOSE FITTING TO FILTER INLET PORT AND CONNECT RIGID LINE (RETURN SYSTEM) TO OUTLET PORT.

ASSURE CASE DRAIN HOSE IS POSITIONED TO PREVENT CONTACT WITH PUMP PRESSURE HOSE. RUBBING CAN CAUSE IN-SERVICE FAILURES.

(5) Connect hydraulic lines to filter module.

(6) Verify that replacement filter module contains filter element(s) (Ref. 29-11-28).

(7) Connect electrical connectors to filter differential-pressure switch and thermal switch.

(8) Remove tags and close circuit breakers opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on electrical power (Ref. 24-41-00).

(10) Remove tags installed in Step 4A(3) and pressurize applicable hydraulic system (Ref. 29-11-00).

NOTE: Engine driven and ATM-driven hydraulic pump case drain filter modules can only be pressurized by pump operation. Check for leakage after first operation.

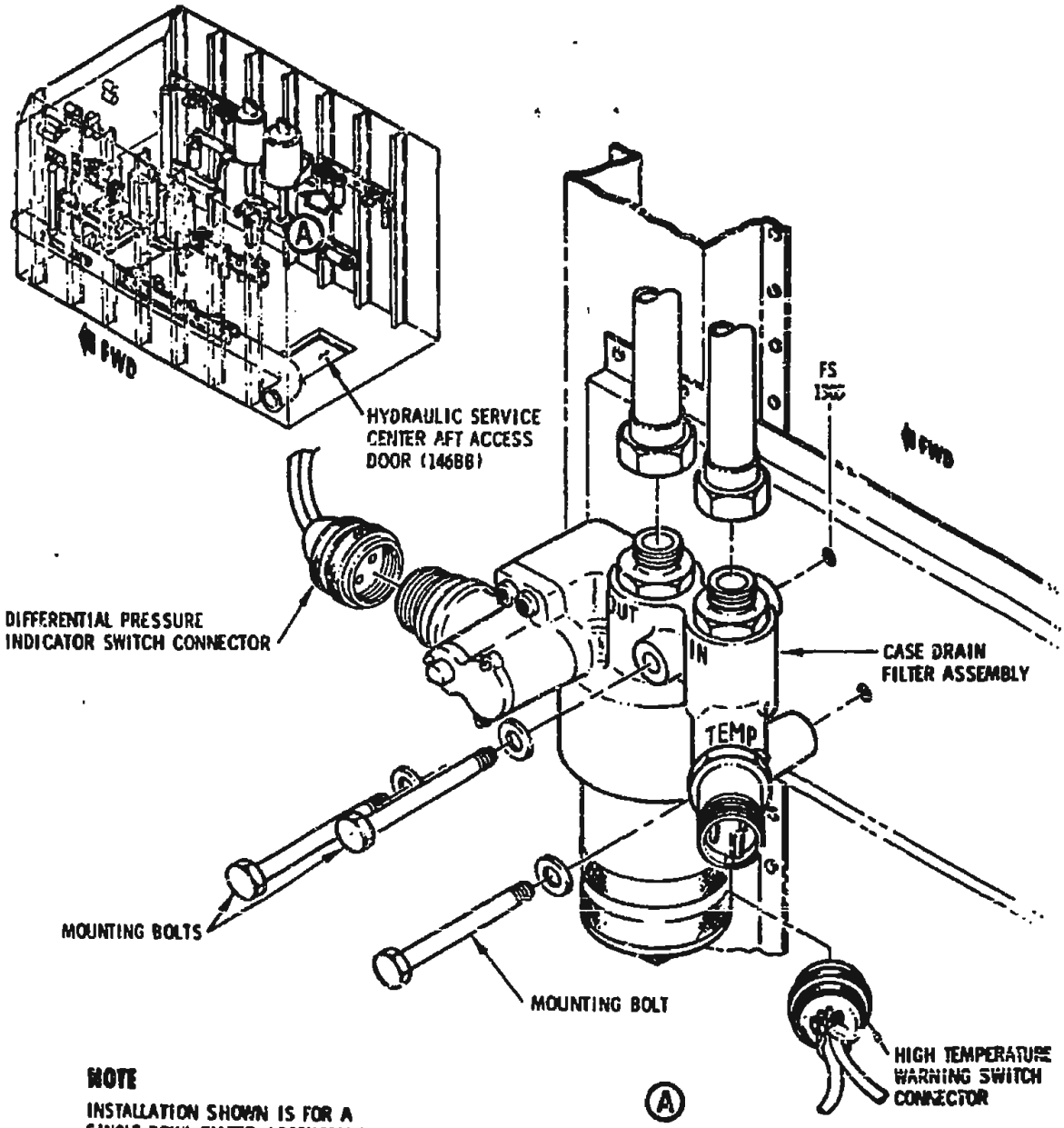
(11) Check filter housing and hydraulic fittings for leakage.

(12) Bleed and replenish applicable system hydraulic reservoir in accordance with placarded instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

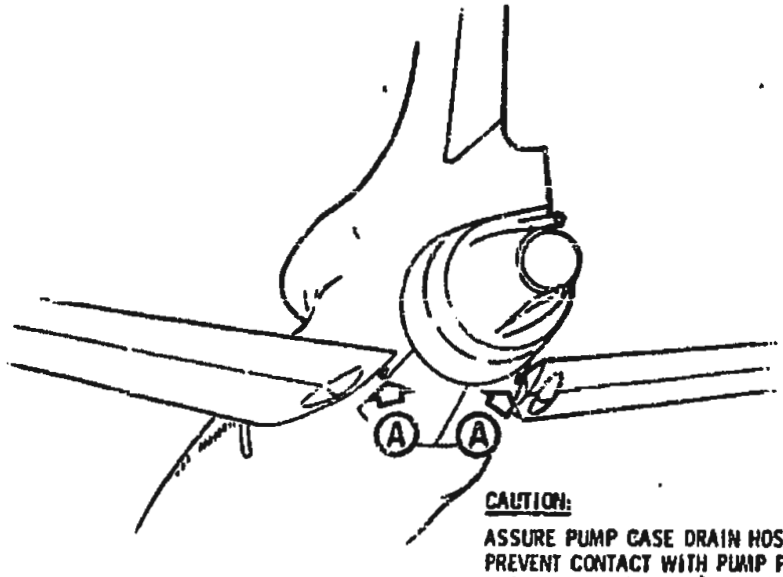
(13) Turn off electrical power (Ref. 24-41-00).

(14) Close and lock hydraulic service center access doors.

(15) Reinstall access panels (Ref. Para. 1).

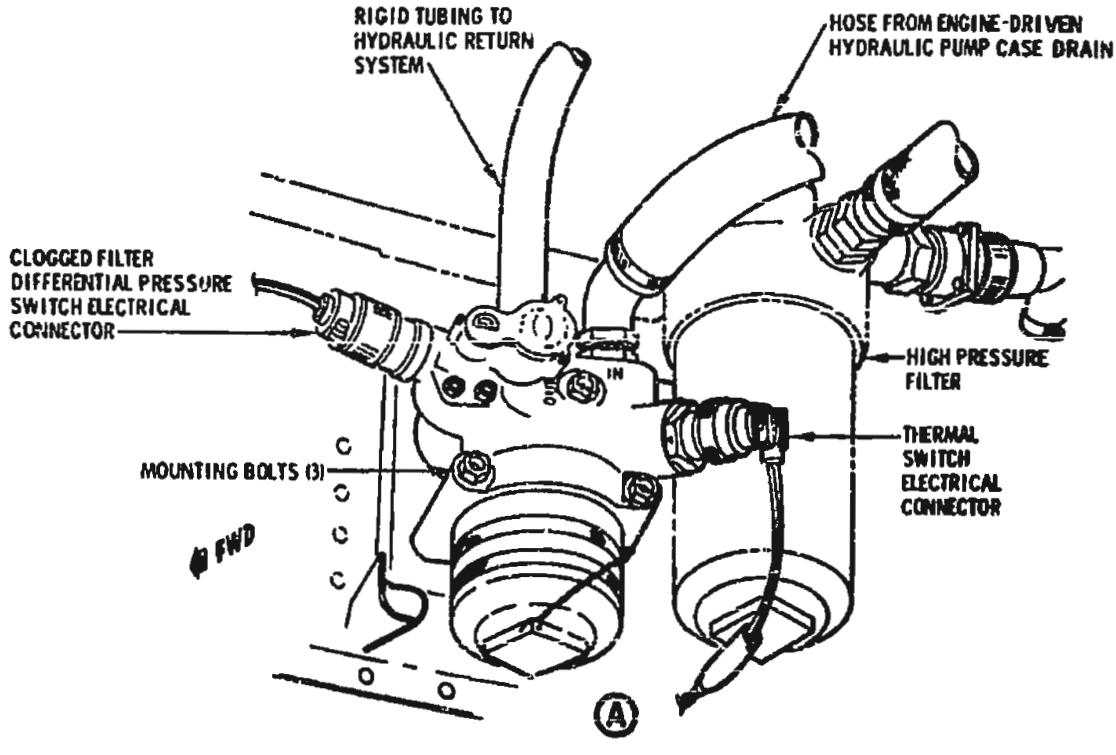

FWD
HYDRAULIC SERVICE CENTER AFT ACCESS DOOR (146BB)
FS
FWD
DIFFERENTIAL PRESSURE INDICATOR SWITCH CONNECTOR
OUT
IN
CASE DRAIN FILTER ASSEMBLY
TEMP
MOUNTING BOLTS
MOUNTING BOLT
HIGH TEMPERATURE WARNING SWITCH CONNECTOR
A
TYPICAL 4 PLACES (SEE NOTE)
NOTE
INSTALLATION SHOWN IS FOR A SINGLE BOWL FILTER ASSEMBLY IN THE HYDRAULIC SERVICE CENTER. FILTER INSTALLATIONS IN PYLONS AND AFT FUSELAGE (CENTER ENGINE) ARE IDENTICAL EXCEPT FOR LOCATION AND ACCESS.
M1-0100-29-152

Case Drain Filter Module - Removal and Installation
Figure 401 (Sheet 1)



CAUTION:

ASSURE PUMP CASE DRAIN HOSE IS POSITIONED TO PREVENT CONTACT WITH PUMP PRESSURE HOSE. RUBBING CAN CAUSE IN-SERVICE FAILURES.



M1-0001-29-168

C Case Drain Filter Module - Removal and Installation
C Figure 401 (Sheet 2)

CASE DRAIN FILTER ELEMENT - REMOVAL AND INSTALLATION

1. General

Removal and installation procedures for all the case drain filter elements are identical, except for filter locations and access panel identifications which are as follows:

R Case drain (engine-driven) Sys A Left pylon - 453 DL

R Case drain (engine-driven) Sys D Right pylon - 463 DR

Case drain (engine-driven) Sys B & C Aft Fus - L & R lower hinged cowl/panels

Case drain PTU, ATM, Sys A,B,C and D - hydraulic service center

Case drain PTU motor & AC pump, Sys B and C - hydraulic service center

2. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Fluid container (3 gallons)

3. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-11-07	Engine-Driven Hydraulic Pump - Removal and Installation
29-11-23	Case Drain Filter Module Assembly - Removal and Installation

4. Removal/Installation

A. Removal

(1) Open applicable access doors (Ref. Para. 1).

R CAUTION: VERIFY APPLICABLE HYDRAULIC SYSTEMS ARE TURNED OFF
R AND SYSTEM ACCUMULATORS ARE DEPRESSURIZED. VERIFY
R ZERO PSI ON HYDRAULIC PRESSURE GAGE ON HYDRAULIC
R SERVICE PANEL. TAG APPLICABLE HYDRAULIC SYSTEM
R CONTROLS ON FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM CONTROL PANEL, ZONE 215, AND
R HYDRAULIC SERVICE PANEL, ZONE 147.

R (2) Locate applicable filter assembly and remove filter bowl assembly (Ref. Fig. 401).

(3) Empty fluid from bowl assembly into fluid container and remove element from filter housing.

NOTE: If metal particles are found in the filter bowl/element, the filter module should be
R replaced (Ref. 29-11-23) or thoroughly cleaned
R (Ref. 29-11-07).

B. Installation

(1) Clean filter bowl and filter element cavity.

(2) Install O-ring in filter housing for filter bowl sealing and verify that filter element contains O-ring.

(3) Lubricate O-rings and filter bowl threads with hydraulic fluid and install element in filter housing.

(4) Fill filter bowl with clean hydraulic fluid. Install filter bowl into module; verify that module flange overlaps bowl flange to confirm full insertion. Torque 10 to 15 lb ft and lock-wire.

(5) Reset differential pressure (clogged filter) caution switch button if it was actuated.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on electrical power (Ref. 24-41-00).

(7) Remove tags installed at beginning of Step 4A(2) and pressurize applicable hydraulic system (Ref. 29-11-00).

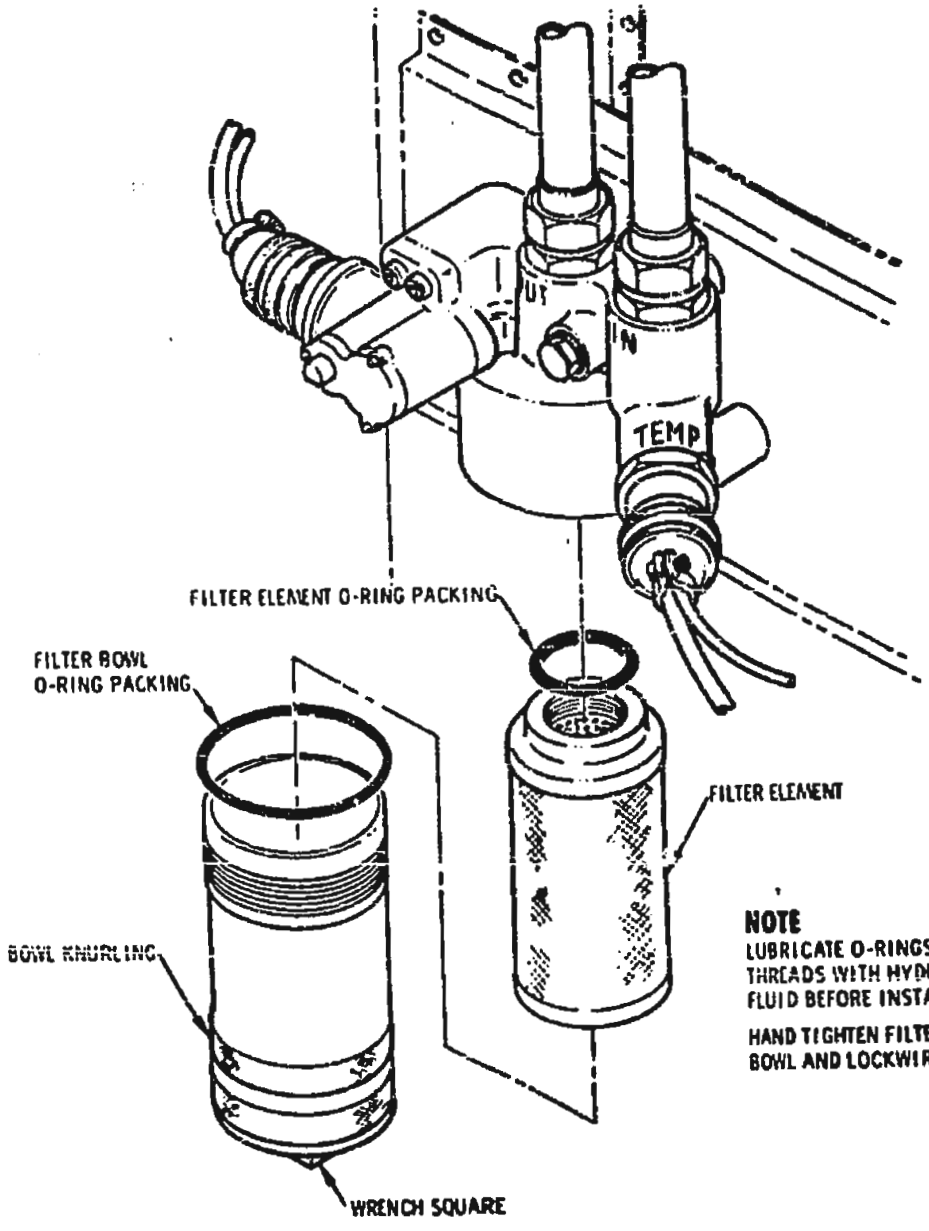
(8) Check filter bowl installation for leakage.

(9) Verify clogged filter indicator light is out.

(10) Turn off electrical power (Ref. 24-41-00).

(11) Close or install access panels opened for access to filter assembly.

R (12) Close and lock access doors opened in Step 4A(1).



R R Case Drain Filter Element - Removal and Installation
Figure 401

R R EFFECTIVITY: ALL

HYDRAULIC SYSTEM PRESSURE RELIEF VALVE - REMOVAL AND INSTALLATION

1. General

The system relief valve cartridges are installed in the high-pressure filter modules located in the hydraulic service center, zone 147. Systems A and B are on the left sidewall, and systems C and D are on the right sidewall.

2. Equipment and Materials

Fluid container (3-gallon plastic pail)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

3. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

WARNING: ENSURE THAT THE APPLICABLE HYDRAULIC SYSTEM IS SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147. DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

R R R R

(1) Open hydraulic service center forward and aft access doors, zone 147.

(2) Position fluid container under applicable valve.

(3) Loosen and unscrew relief valve from filter module (Ref. Fig. 401).

(4) Cover filter module cavity to prevent contamination.

B. Installation

(1) Remove protective covering from filter module cavity.

(2) Before installing relief valve, check that:

(a) Filter module cavity is clean.

(b) Valve O-rings, backup rings, and cap seal are properly installed.

(c) Valve index ring is installed.

(3) Lubricate O-rings with hydraulic fluid.

(4) Install valve in module cavity, tighten and lock-wire.

R R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

R R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R R R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

R R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on electrical power (Ref. 24-41-00).

(6) Remove tags installed at beginning of Paragraph 4.

(7) Check reservoir fluid level; replenish if required (Ref. 12-13-01).

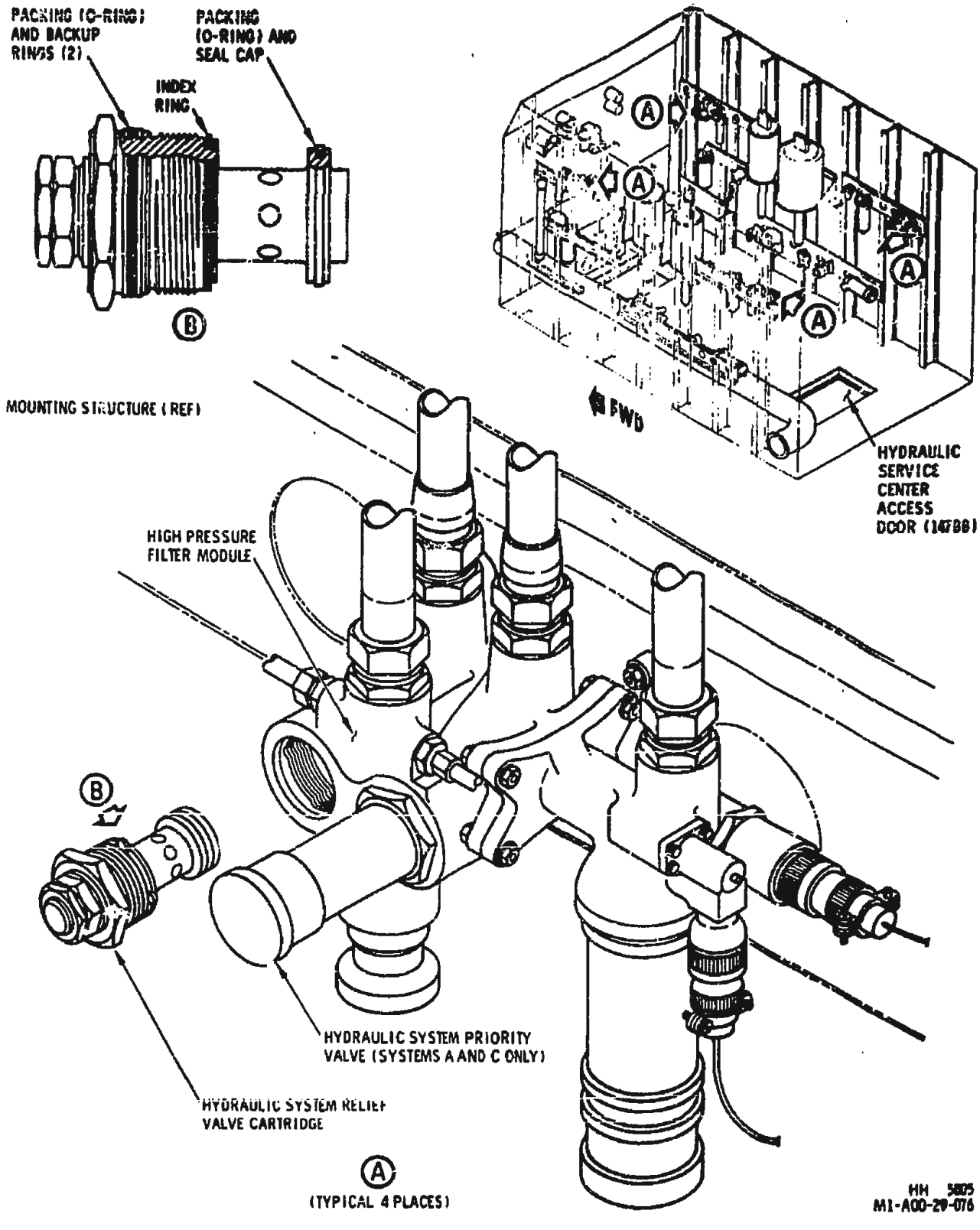
(8) Turn on hydraulic pressure for applicable system and bleed system of air as follows:

(a) On pilots overhead PFCS panel, position all except SPOILER L & R2 switchlights to OFF or INOP.

(b) Turn on B3 and C3 AC pumps.

(c) For systems A, B, and C: turn on B-A PTU and operate flaps (1 cycle).

(d) For system D: turn on C-D PTU and operate speed brake (spoilers) through 15 cycles.



Hydraulic System Pressure Relief Valve - Removal and Installation
Figure 401

(e) Shut off PTU and AC pumps.

(f) Release servo switchlights depressed in Step (a).

(9) Check for fluid leakage at relief valve.

(10) Perform reservoir AIR BLEED, AIR CHECK and FLUID QUANTITY CHECK in accordance with reservoir service instructions placard (Ref. 12-13-01).

(11) Turn off hydraulic pressure (Ref. 29-11-00).

(12) Turn off electrical power (Ref. 24-41-00).

(13) Close and lock hydraulic service center access doors.

HYDRAULIC SYSTEM PRIORITY VALVE - REMOVAL AND INSTALLATION

1. General

R The system priority valve cartridges are installed in the A and
R C high-pressure filter modules located in the hydraulic service
R center, zone 147. System A is on the left sidewall, and system
R C is on the right sidewall.

2. Equipment and Materials

Fluid container (3-gallon plastic pail)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

3. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-11-01	Hydraulic Bootstrap Reservoir - Servicing

4. Removal/Installation

A. Removal

WARNING: ENSURE THAT THE APPLICABLE HYDRAULIC SYSTEM IS SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Open hydraulic service center forward and aft access doors, zone 147.

(2) Position fluid container under applicable valve.

WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

(3) Loosen and unscrew priority valve from filter module (Ref. Fig. 401).

(4) Cover filter module cavity to prevent contamination.

B. Installation

(1) Remove protective covering from filter module cavity.

(2) Before installing priority valve, check that:

(a) Filter module cavity is clean.

(b) Valve O-rings, backup rings, and cap seal are properly installed.

(c) Valve index ring is installed.

(3) Lubricate O-rings with hydraulic fluid.

(4) Install valve in module cavity, tighten and lock-wire.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on electrical power (Ref. 24-41-00).

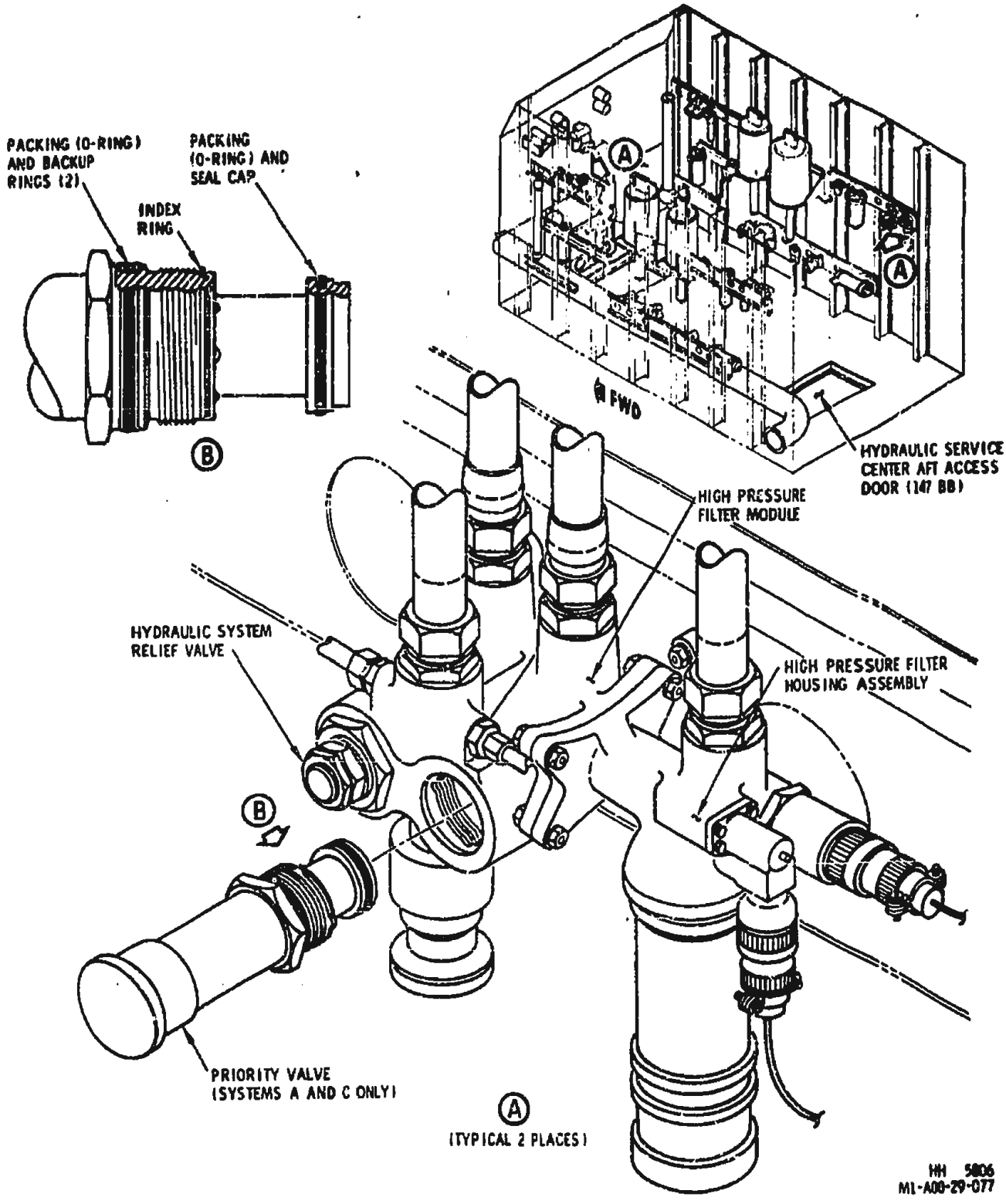
(6) Remove tags installed at beginning of Paragraph 4.

(7) Check reservoir fluid level; replenish if required (Ref. 12-13-01).

R (8) Turn on hydraulic pressure for systems A or C as
R applicable (Ref. 29-11-00). Bleed system of air by
R operating flaps one complete cycle.

(9) Check for fluid leakage at priority valve.

(10) Perform reservoir AIR BLEED, AIR CHECK, and FLUID QUANTITY CHECK in accordance with RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).



Hydraulic System Priority Valve - Removal and Installation
Figure 401

(11) Turn off hydraulic pressure (Ref. 29-11-00).

(12) Turn off electrical power (Ref. 12-13-01).

(13) Close and lock hydraulic service center access doors.

HYDRAULIC SYSTEM PRIORITY VALVE - ADJUSTMENT AND TEST

1. Equipment and Materials

Hydraulic Ground Test Cart, B784C, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing - Servicing
24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-00	Wing Trailing Edge Flap Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Adjustment/Test

A. Operational Test

(1) Connect hydraulic ground test cart.

(a) Open hydraulic service center access doors 147AB and 147BB (Ref. Fig. 501).

(b) Remove cap assemblies, and connect hydraulic ground test cart pressure and return hoses to applicable system pressure and return quick disconnects, using the aft access door for hose entry (Ref. Fig. 501). Priority valves are in systems A and C.

(c) Install hose support assembly on aft access door sill and attach hoses to prevent excessive loads on quick disconnect fittings.

NOTE: To prevent overflow of aircraft reservoirs during ground test cart operation, position controls on test cart to isolate test cart reservoirs and operate test cart using aircraft reservoirs. If the above cannot be accomplished, adjust test cart return pressure to maximum of 45 psi.

R (2) Establish communications between hydraulic ground test
R cart and flight station.

(3) Turn on electrical power (Ref. 24-41-00).

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

FLAP CONTROLS

NO. 2 ASYM BK - TE FLAP (J11)

LOCK LIGHT - TE FLAP (J13)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

HYDRAULIC

INDICATORS - PRESS (M13)

NO. 1 ASYM BRAKE - TE FLAP (H21)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed:

POSN IND - TE FLAP (K16)

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

RAM AIR TURBINE (RAT) SAFETY LOCK IS INSTALLED OVER THE RAT DOORS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Operate hydraulic ground test cart to pressurize system to 2400 (±50) psi.

(6) Release (out) slat lock switchlight on the Flight Engineer/Second Officers SLAT MONITOR panel, zone 215.

R (7) Position flap control handle to initiate flap travel
R (extend or retract) and monitor flap position indicator
R (Ref. 27-51-00).

R (8) Reduce system pressure on the hydraulic ground test
R cart to 1900 (±50) psi.

R (9) Verify that flap travel stops while pressure is
R reduced.

R NOTE: The priority valve must shut off hydraulic
R pressure to the flaps and slats when the system
R pressure is below approximately 2100 psi.

R (10) Increase system pressure on the hydraulic ground test
R cart to 2400 (±50) psi and verify that flap travel
R continues.

R (11) Position flaps to UP position.

R (12) Depress slat lock switchlight on SLAT MONITOR panel.

R NOTE: When ground test cart operation is completed,
R replenish applicable aircraft reservoir(s) to
R normal fluid level as specified on RESERVOIR
R SERVICING placard (Ref. 12-13-01).

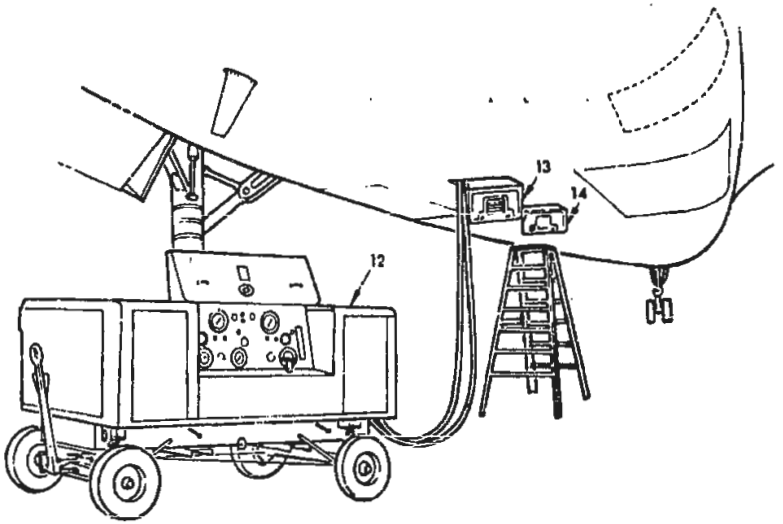
R (13) Shut down hydraulic ground test cart.

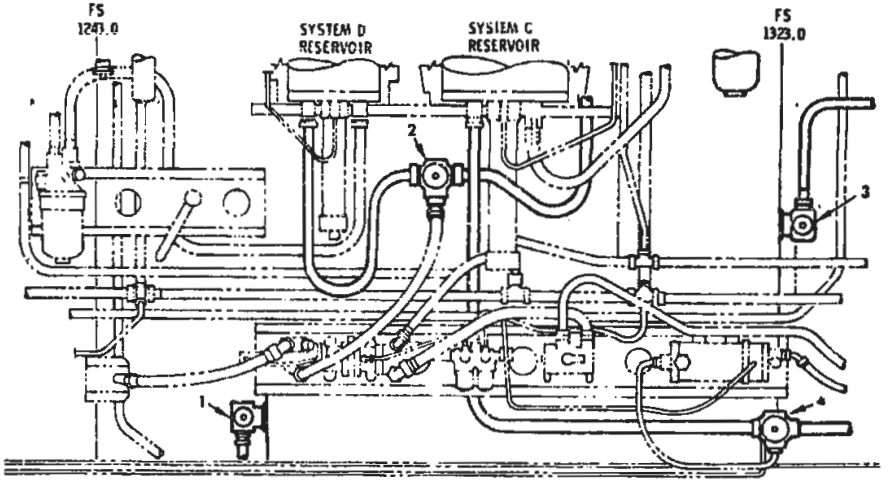
R (14) Disconnect hydraulic hoses from pressure and return
R quick disconnects, and reinstall dust caps on each
R quick disconnect. If the other priority valve is to be
R tested, connect the hydraulic ground test cart pressure
R and return hoses to applicable system pressure and
R return quick disconnects and repeat Steps 5 thru 13 of
R operational test.

(15) Remove hose support assembly from hoses and aft access door sill.

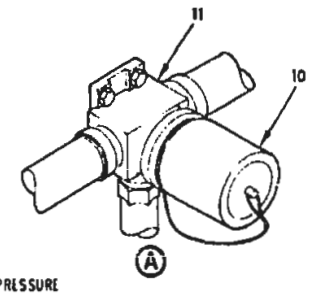
(16) Close and lock hydraulic service center doors.

(17) Turn off electrical power (Ref. 24-41-00).



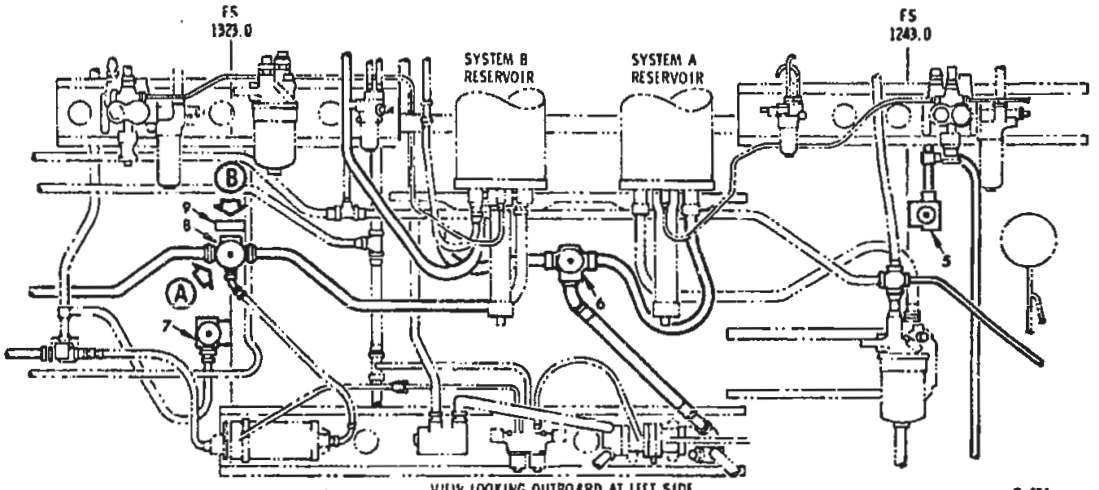


VIEW LOOKING OUTBOARD AT RIGHT SIDE



GROUND SERVICE-SYS B
RETURN - 85PSI
USE FLUID PER LOCKHEED SPEC
C-34-1224 TYPE II OR III

Ⓑ



VIEW LOOKING OUTBOARD AT LEFT SIDE

G 434
M1-0100-29-115

HYDRAULIC SERVICE CENTER

1 GROUND SERVICE FITTING, SYS D PRESSURE
2 GROUND SERVICE FITTING, SYS D RETURN
3 GROUND SERVICE FITTING, SYS C PRESSURE
4 GROUND SERVICE FITTING, SYS C RETURN
5 GROUND SERVICE FITTING, SYS A PRESSURE
6 GROUND SERVICE FITTING, SYS A RETURN
7 GROUND SERVICE FITTING, SYS B PRESSURE
8 GROUND SERVICE FITTING, SYS B RETURN
9 GROUND SERVICE CONNECTION PLACARD (TYPICAL 8 PLACES)
10 PROTECTIVE CAP
11 GROUND SERVICE FITTING (TYPICAL)
12 HYDRAULIC GROUND TEST CART (3000 PSI, 40 GPM)
13 HYDRAULIC SERVICE CENTER AFT ACCESS DOOR (147BB)
14 HYDRAULIC SERVICE CENTER FORWARD ACCESS DOOR (147AB)

R Hydraulic System Pressurization (Using Hydraulic Ground Test Cart)
R Figure 501

R EFFECTIVITY: ALL

0016

R HYDRAULIC FIREWALL SHUTOFF VALVE - MAINTENANCE PRACTICES

R 1. General

R The following procedure applies to a hydraulic firewall shutoff
R valve which is inoperative closed.

R 2. Referenced Procedure

R 29-11-07 Engine-Driven Hydraulic Pump - Maintenance
R Practices

R 3. Deactivation

R A. Hydraulic Firewall Shutoff Valve (System B or C).

R WARNING: BEFORE ENTERING ACCESS DOOR 317BB TO GAIN ACCESS
R TO ZONE 317, ENSURE THAT ALL FOUR HYDRAULIC
R SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT
R ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL,
R ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE
R 147. INSTALL CONTROL COLUMN AND TRIM WHEEL LOCK.

R CAUTION: USE CAUTION WHILE GAINING ACCESS INTO ZONE 317
R THROUGH ACCESS DOOR 317BB TO PREVENT DAMAGE TO
R HYDRAULIC LINES AND COMPONENTS.

R (1) Gain access to zone 317 and verify that the applicable
R hydraulic firewall shutoff valve is in CLOSED position.

R (2) Deactivate the associated engine-driven pump (B1 or C1)
R in accordance with approved maintenance procedures
R (29-11-07).

R (3) Place inoperative placard on HYDRAULIC SYSTEM control
R panel for the inoperative firewall shutoff valve and
R deactivated pump.

R (4) On pilots overhead circuit breaker panel CB1, zone 210,
R open and tag applicable circuit breaker HYD PUMP &
R FIREWALL SHUTOFF VALVE CONT (L16, L17) for system B or
R C.

R (5) Make appropriate entry in aircraft log book.

HYDRAULIC FIREWALL SHUTOFF VALVE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec. QQ-W-390, 0.032 diameter, or equivalent

Protective plugs and caps, LS12995-20, or equivalent

Gasket (O-ring), LS10116-20, or equivalent

Control Column and Trim Wheel Lock, PN BA80, or equivalent

2. Referenced Procedures

29-11-00	Hydraulic Power System - Maintenance Practices
29-11-32	Hydraulic Firewall Shutoff Valve - Adjustment and Test
24-41-00	External Power/Ground Service System - Maintenance Practices
71-00-00	Power Plant - Adjustment and Test
72-13-02	Hydraulic Fluid Replenishing

3. Removal/Installation

A. Removal

(1) On the pilots overhead circuit breaker panel CB1, zone 210, open and tag HYD PUMP & FIREWALL SHUTOFF VALVE CONT circuit breaker for the applicable system (A, B, C, or D L15 through L18).

R WARNING: BEFORE ENTERING ACCESS DOOR 317BB TO GAIN ACCESS TO ZONE 317, ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147. INSTALL CONTROL COLUMN AND TRIM WHEEL LOCK.

R CAUTION: USE CAUTION WHILE GAINING ACCESS INTO ZONE 317 THROUGH ACCESS DOOR 317BB TO PREVENT DAMAGE TO HYDRAULIC LINES AND COMPONENTS.

(2) Use adjustable height workstand to remove access panel 453DR or 463DL for engines No. 1 or No. 3 respectively

(Ref. Fig. 401), and access panel 3178B for engine No. 2 hydraulic firewall shutoff valves.

NOTE: The valves for systems B and C (engine No. 2) are located near the outside fuselage SKIN on horizontal pan structure, above and forward of the horizontal stabilizer pivot bearing on the left and right sides of the S-duct (Ref. Fig. 402). Access is through access panel 3178B and upward between the pressure bulkhead and the leading edge of the horizontal stabilizer boxbeam.

(3) Disconnect electrical connector from firewall shutoff valve.

R CAUTION: BEFORE DISCONNECTING HYDRAULIC FITTING, VERIFY THAT THE APPLICABLE HYDRAULIC SYSTEM RESERVOIR PRESSURE GAGE INDICATES ZERO PSI (OPERATE RESERVOIR DEPRESSURIZATION VALVE UNTIL GAGE ON HYDRAULIC SERVICE PANEL INDICATES ZERO PSI).

(4) Disconnect hydraulic lines from valve.

(5) Place protective plugs and caps on all disconnected lines and fittings.

(6) Remove nuts and washers from valve mounting bolts (3 each for wing engines, mounting bracket for fuselage engine shutoff valves contains plate nuts). Remove bolts from mounting bracket and the valve mounting lugs.

(7) Remove valve from mounting brackets.

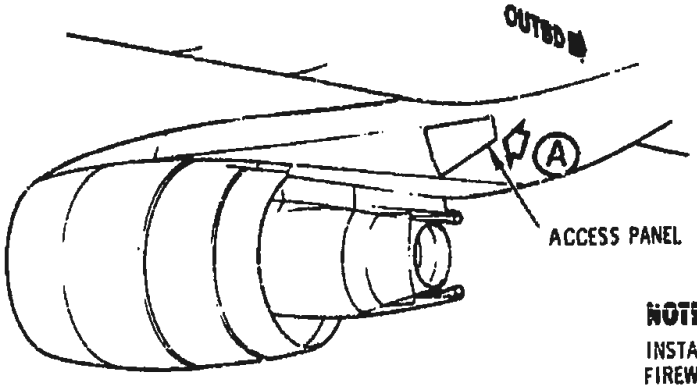
(8) Remove adapter fittings from valve for replacement valve.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

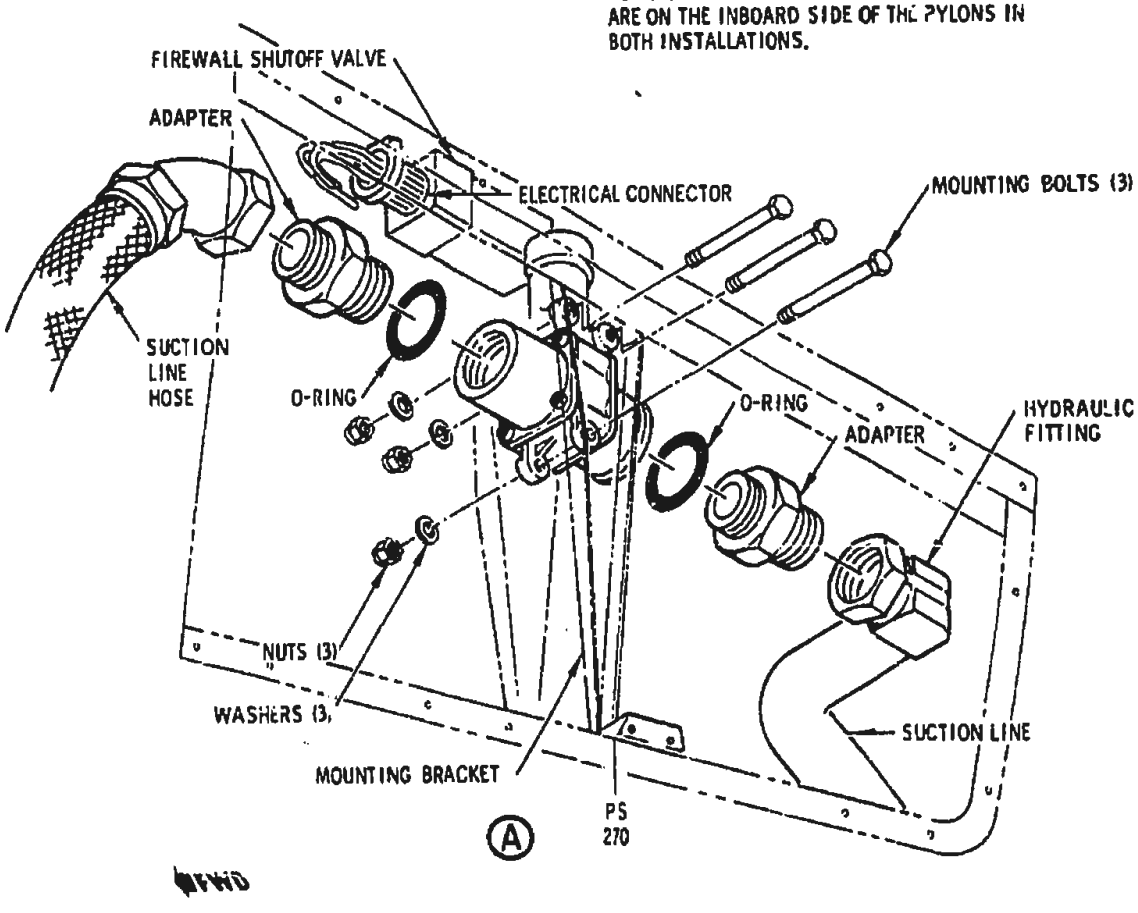
R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147. INSTALL CONTROL COLUMN AND TRIM WHEEL LOCK.

(2) Install adapter fitting in downstream and upstream end of shutoff valve. Use new gasket lubricated with hydraulic fluid.



NOTE

INSTALLATION SHOWN IS FOR SYSTEM D FIREWALL SHUTOFF VALVE (ENGINE NO.3PYLON). THE INSTALLATION FOR SYSTEM A FIREWALL SHUTOFF VALVE IN ENGINE NO.1 PYLON IS ESSENTIALLY IDENTICAL, EXCEPT THE ELECTRICAL CONNECTOR IS POSITIONED AFT. THE ACCESS PANELS ARE ON THE INBOARD SIDE OF THE PYLONS IN BOTH INSTALLATIONS.



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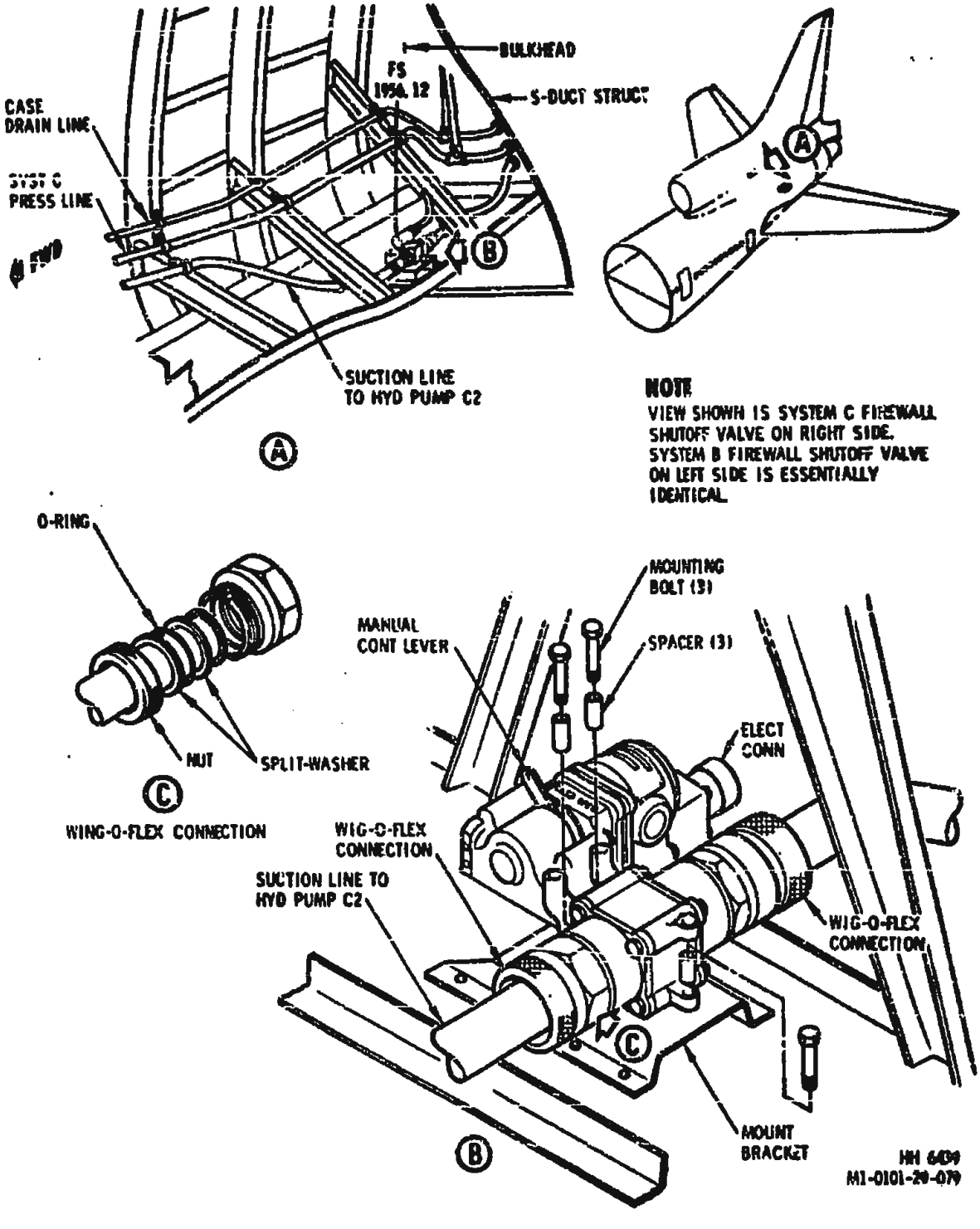
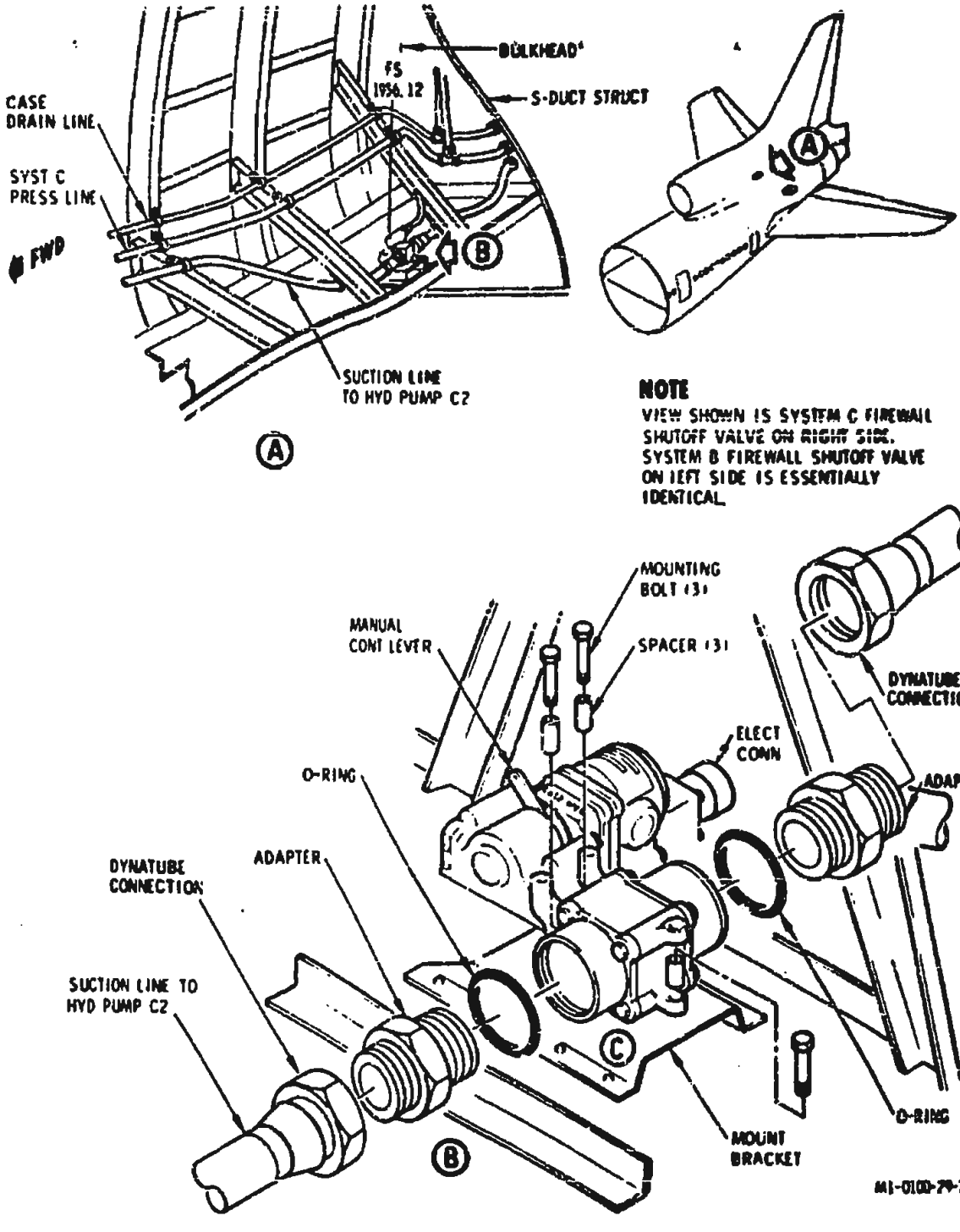
R Hydraulic Firewall Shutoff Valve (Wing Engine)
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL



R Hydraulic Firewall Shutoff Valve (Fuselage Engine)
R Removal and Installation
R Figure 402



R Hydraulic Firewall Shutoff Valve (Fuselage Engine)
R Removal and Installation
R Figure 402

EFFECTIVITY: 015-999

(3) Position shutoff valve in mounting brackets and install mounting bolts (Ref. Fig. 401 for wing engines, Fig. 402 for fuselage engine installation).

(4) Remove protective plugs and caps from hydraulic lines and connect lines to shutoff valve fittings.

(5) Connect electrical connector to shutoff valve and lock-wire.

(6) Remove tag and close circuit breaker opened in Step 3A(1).

(7) Turn on electrical power (Ref. 24-41-00).

(8) Check applicable reservoir fluid level; replenish if required (Ref. 12-13-01).

(9) Perform system air bleed operation as follows:

(a) On pilots overhead panel, release (out) the PFCS panel RUDDER, STABILIZER, AILERON, and SPOILER switchlights to OFF or INOP.

NOTE: Flight control servos are shut off to prevent air movement into flight control systems.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(b) Turn on applicable AC MOTOR PUMP (and PTU for systems A or D).

(c) Verify that the applicable reservoir is pressurized (70 to 85 psi).

(d) Motor the applicable engine (Ref. 71-00-00). During engine motoring, operate controls applicable to system in which firewall shutoff valve was replaced, as follows:

System A: operate flaps (1 cycle)

System B: operate B-A PTU and flaps (1 cycle)

System C: operate flaps (1 cycle)

System D: on PFCS panel, position AILERON switchlights to on (OFF lights out) and operate control wheel (10 cycles)

(e) Depress (latch in) flight control switchlights released in Step (a).

(10) Stop motoring the engine (Ref. 71-00-00).

(11) Check firewall shutoff valve and fittings for evidence of leakage.

(12) Perform reservoir AIR CHECK and RESERVOIR AIR BLEED in accordance with instructions on RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(13) Turn off AC MOTOR PUMP and PTU.

(14) Turn off electrical power (Ref. 24-41-00).

(15) Test valve operation (Ref. 29-11-32, Adjustment and Test).

HYDRAULIC FIREWALL SHUTOFF VALVE - ADJUSTMENT AND TEST

1. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

2. Adjustment/Test

A. Operational Test

(1) Turn on electrical power (Ref. 24-41-00).

(2) On pilots overhead circuit breaker panel CB1 open and tag the following circuit breakers:

FUEL SHUTOFF VALVE (D10), (D11), (D12) and (D14)

(3) On Flight Engineer/Second Officers aft circuit breaker panel CB3, open and tag the following circuit breakers:

FUEL SYSTEM

ENG 1 EMERG & L XFEED (T7)

ENG 2 SEC EMERG & C XFEED (T10)

ENG 3 EMERG & R XFEED (T13)

ENG NO. 1

ACCESS VENT AIR (N1)

ENG NO. 2

ACCESS VENT AIR (N7)

ENG NO. 3

ACCESS VENT AIR (N13)

(4) On pilots overhead circuit breaker panel CB1, verify that the following circuit breakers are closed:

HYD PUMP & FIREWALL SHUTOFF VALVE CONT (L15) through (L18)

ENG START PWR (B15)

(5) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that the following circuit breakers are closed:

HYDRAULIC

SYS A PUMP (M15)

SYS B PUMP (M17)

SYS C PUMP (M19)

SYS D PUMP (M21)

(6) On Flight Engineer/Second Officers aft circuit breaker panel CB3, verify that the following circuit breaker is closed:

ENG START PWR (F10)

(7) Provide access to the hydraulic system firewall shutoff valves as follows:

(a) Engine No. 1 (Sys A) and Eng No. 3 (Sys D) open inspection door in access panels 453 DR, 463 DL (Ref. 6-40-00).

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

INSTALL CONTROL COLUMN YOKE SAFETY BAR TO PREVENT MOVEMENT OF HORIZONTAL STABILIZER IN THE EVENT OF HYDRAULIC SYSTEM PRESSURIZATION.

(b) Engine No. 2 (systems B and C), open access door 317BB to gain access to upper surface of horizontal stabilizer, left and right sides at S duct (Ref. 6-40-00).

(8) Provide access to engine-driven hydraulic pumps, A1, B1, C1, and D1 as follows:

(a) Pumps A1 and D1, open engine cowl panels 413 and 414 for engine No. 1 and panels 423 and 424 for engine No. 3.

(b) Pumps B1 and C1, open lower hinged panels 433 and 434 for engine No. 2.

(9) On the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, verify that the SUCT S/O and PUMP S/O switchlights for engine-driven pumps A1, B1, C1, and D1 are depressed (flowbars on).

(10) Pull out engine No. 1 FIRE PULL handle and verify the following:

(a) Hydraulic firewall shutoff valve (engine No. 1 left pylon) manual lever moves to CLSD.

(b) Engine-driven pump A1 depressurization valve solenoid is energized (solenoid can be heard when it actuates and an increase in solenoid case temperature can be detected by hand contact).

(11) Close (push in) engine No. 1 FIRE PULL handle and verify the following:

(a) Firewall shutoff valve manual lever moves to OPEN.

(b) Pump A1 depressurization valve solenoid is deenergized.

(12) Lift the guard on A1 SUCT S/O switchlight, release switch and verify the following:

(a) Flowbar goes out and OFF legend comes on.

(b) Firewall shutoff valve manual lever moves to CLSD.

(13) Depress SUCT S/O switchlight and verify the following:

(a) Flowbar comes on and OFF legend goes out.

(b) Firewall shutoff valve manual lever moves to OPEN.

(14) Pull out engine No. 2 FIRE PULL handle and verify the following:

(a) Hydraulic firewall shutoff valve (engine No. 2 aft fuselage) manual levers move to CLSD (systems B and C).

(b) Engine-driven pumps B1 and C1 depressurization valve solenoids are energized (audible and temp increase).

R (15) Close (push in) engine No. 2 FIRE PULL handle and verify the following:

(a) Firewall shutoff valve manual levers move to OPEN.

(b) Pumps B1 and C1 depressurization valve solenoids are deenergized.

R (16) Lift the guard on B1 SUCT S/O switchlight, release switch and verify the following:

(a) Flowbar goes out and OFF legend comes on.

(b) Firewall shutoff valve manual lever moves to CLSD (system B).

R (17) Depress SUCT S/O switchlight and verify the following:

(a) Flowbar comes on and OFF legend goes out.

(b) Firewall shutoff valve manual lever moves to OPEN.

R (18) Lift guard on C1 SUCT S/O switchlight, release switch and verify the following:

(a) Flowbar goes out and OFF legend comes on.

(b) Firewall shutoff valve manual lever moves to CLSD (system C).

R (19) Depress SUCT S/O switchlight and verify the following:

(a) Flowbar comes on and OFF legend goes out.

(b) Firewall shutoff valve manual lever moves to OPEN.

R (20) Pull out engine No. 3 FIRE PULL handle and verify the following:

(a) Hydraulic firewall shutoff valve (engine No. 3 right pylon) manual lever moves to CLSD (system D).

(b) Engine-driven pump D1 depressurization valve solenoid is energized (audible and temp increase).

R (21) Close (push in) engine No. 3 FIRE PULL handle and verify the following:

(a) Firewall shutoff valve manual lever moves to OPEN.

(b) Pump D1 depressurization valve solenoid is deenergized.

(22) Lift the guard on D1 SUCT S/O switchlight, release switch and verify the following:

(a) Flowbar goes out and OFF legend comes on.

(b) Firewall shutoff valve manual lever moves to CLSD (system D).

(23) Depress SUCT S/O switchlight and verify the following:

(a) Flowbar comes on and OFF legend goes out.

(b) Firewall shutoff valve manual lever moves to OPEN.

(24) Turn off electrical power (Ref. 24-41-00).

(25) Remove tags and close circuit breakers opened in Steps 2A(2) and (3).

(26) Close access panels and doors opened for access to firewall shutoff valves and engine-driven hydraulic pumps.

(27) Remove tags from hydraulic system control panels, zone 215, and 147.

(28) Remove control column yoke safety bar.

POWER TRANSFER UNIT (PTU) - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid Container (3 gallons, approximately)

Hydraulic Fluid,LAC Spec C-34-1224, or equivalent

Hydraulic Service Dolly, (Ref ITEL 12-13-03), or equivalent

Protective caps and plugs, LS 12994-6, -20, or equivalent

Preformed packing (Ref. Fig. 401)

2. Referenced Procedures

12-13-01 Hydraulic Fluid Replenishing.

24-41-00 External Power/Ground Service System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers PTU CONT & IND SYST B-A (L14), or C-D (L15) and AC PUMP B3 (L12), or C3 (L22). (system B or C).

(2) Open service center access doors 147 AB and 147BB.

NOTE: The PTU are mounted on the left and right sidewalls below the system B and C reservoirs. Removal and installation procedures are identical for either PTU.

R CAUTION: USE EXTREME CARE TO PREVENT DAMAGE TO HOSES FROM
R BENDING OR KINKING DURING PTU REMOVAL. DO NOT
R SUPPORT THE WEIGHT OF THE ATTACHED COMPONENT FROM
R THE HOSES.

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
R LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC
R PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

(3) Disconnect hydraulic connectors from PTU fittings (Ref. Fig. 401). Use container to catch fluid drainage.

(4) Install protective caps and plugs on hydraulic lines to stop fluid drainage.

(5) Remove hydraulic fitting adapters from PTU for installation on replacement unit. Discard preformed packings (O-rings).

(6) Remove PTU mounting bolts, and remove PTU.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged, and check that:

(a) All fittings and connectors are clean

(b) Pump and motor case housings are filled with hydraulic fluid

(2) Install new O-rings on adapter fittings and install in PTU ports.

(3) Position PTU in place and install mounting bolts (pump section of unit is mounted forward on each installation).

R CAUTION: USE EXTREME CARE TO PREVENT BENDING, KINKING OR
R CAUSING A TWISTING PRELOAD IN THE HOSE WHEN
R TIGHTENING FITTINGS.

(4) Remove protective caps and plugs from fittings and connectors. Connect hydraulic lines to the PTU fittings.

(5) Remove tags and close circuit breakers opened in Step 3A(1).

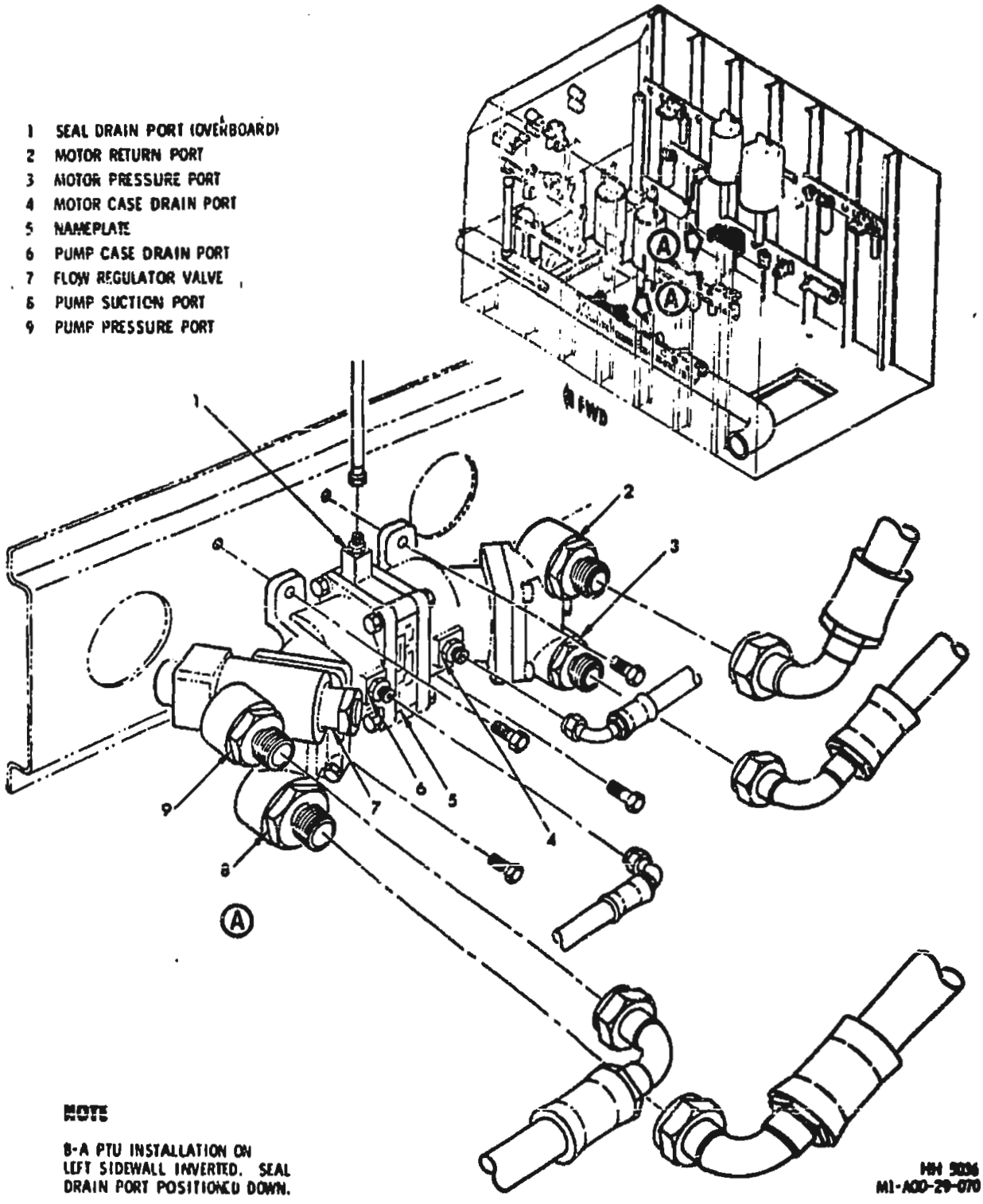
R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on electrical power (Ref. 24-41-00).



Power Transfer Unit (PTU) - Removal and Installation
Figure 401

(7) To bleed B-A PTU, operate controls as follows:

(a) On the pilots overhead PFCS panel, position all system A servos to OFF or INOP.

(b) Turn on B3 AC MOTOR PUMP and B-A PTU.

(c) Operate flaps through one cycle.

(d) Perform system A and B reservoir AIR BLEED and AIR CHECK in accordance RESERVOIR SERVICE INSTRUCTIONS placard, zone 147, and replenish reservoirs as required (Ref. 12-13-01).

(e) Shut off B-A PTU and B3 AC MOTOR PUMP.

(f) Release switchlights depressed in Step (a).

(8) To bleed C-D PTU, operate controls as follows:

(a) On the pilots overhead PFCS panel, release (out) all system D servo switchlights to OFF or INOP except the SPOILER R & L2.

(b) Turn on C3 AC MOTOR PUMP and the C-D PTU.

(c) Operate speed brakes through 15 complete cycles.

(d) Perform system C and D reservoir AIR BLEED and AIR CHECK in accordance with RESERVOIR SERVICE INSTRUCTIONS placard, zone 147, and replenish reservoirs as required (Ref. 12-13-01)

(e) Shut off C-D PTU and C3 AC MOTOR PUMP.

(f) Depress (latch in) switchlights released in Step (a).

(9) Turn off electrical power (Ref. 24-41-00).

(10) Check PTU and all hydraulic connections for any evidence of leakage.

(11) Close and lock hydraulic service center access doors.

POWER TRANSFER UNIT CONTROL MODULE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3 gallons, approximately)

Protective caps and plugs

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker PTU CONT & IND SYS B or C (L14, 15), as applicable and tag applicable hydraulic system controls on Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215 and HYDRAULIC SERVICE PANEL, zone 147, to prevent pressurization of system during PTU control module removal and installation

(2) Open service center accesss doors 147AB and 147BB.

The power transfer unit (PTU) control modules are located aft of the PTU on the left and right sidewalls.

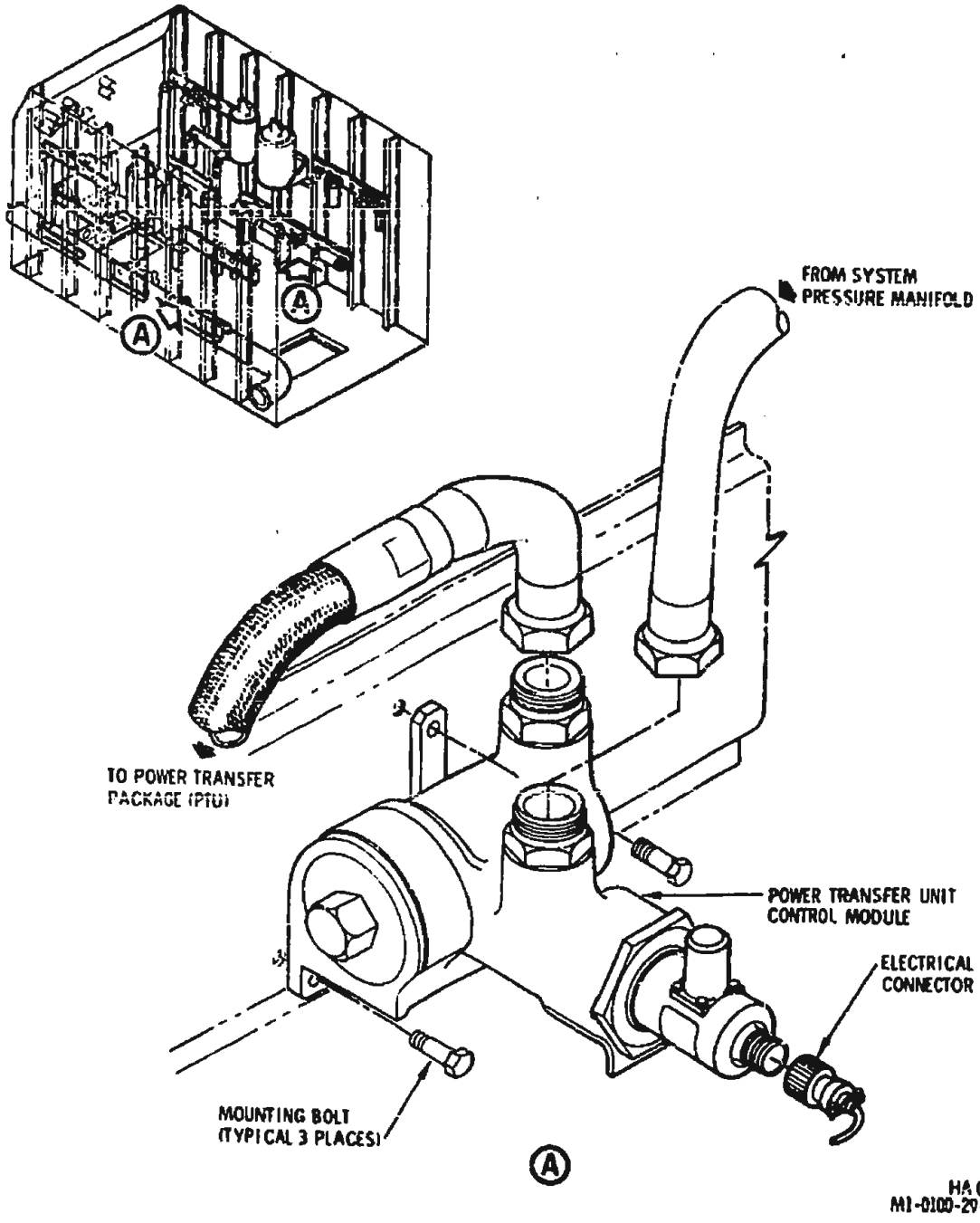
(3) Disconnect electrical connector from shutoff valve (Ref. Fig. 401).

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING
R ANY HYDRAULIC LINES. VERIFY ZERO PSI AT
R RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE
R PANEL (REF. 29-11-00,201).

(4) Position fluid container under PTU control module and disconnect hydraulic pressure line from module inlet port and hose from module outlet port.

(5) Place plugs and caps on open ports as required.

(6) Remove mounting bolts and remove PTU control module.



R Power Transfer Unit Control Module - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL

R

0508

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged and that switches tagged are in OFF position.

(2) Position PTU control module in place and install mounting bolts.

(3) Remove protective caps and plugs from fittings and connectors. Connect hydraulic line to inlet port and hose to outlet port of module. Connect electrical connector to PTU solenoid shutoff valve.

(4) Remove tag and close circuit breaker opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on electrical power (Ref. 24-41-00).

(6) Pressurize and bleed applicable system as follows:

(a) On pilots overhead PFCS panel, position all flight control servo switchlights except system D AILERON R INBD and R OUTBD switchlights to OFF or INOP.

(b) Turn on B3 and C3 AC pumps.

(c) For B-A PTU control module, turn on B-A PTU and operate flaps (1 cycle).

(d) For C-D PTU control module, turn on C-D PTU and operate control wheel (ailerons) 5 cycles.

(7) Check for leakage at PTU control module and fittings.

(8) Perform applicable reservoir AIR CHECK, AIR BLEED and FLUID QUANTITY CHECK in accordance with instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(9) Turn off electrical power (Ref. 24-41-00).

(10) Close and lock hydraulic service center access doors.

POWER TRANSFER UNIT SOLENOID SHUTOFF VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3 gallons)

Lock-wire, Fed Spec QQ-W-390 0.032-inch diameter, or equivalent

2. Referenced Procedure

R 12-13-01 Hydraulic Fluid Replenishing

24-41-00 External Power/Ground Service System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit
R breaker PTU CONST & IND SYS B or C (L14,15) as applicable.

(2) Open service center access doors 147AB and 147BB.

NOTE: The PTU solenoid shutoff valves are installed in the PTU control modules located on the left and right sidewalls below systems B and C reservoirs. Removal and installation procedures are identical for either valve.

(3) Disconnect electrical connector from shutoff valve (Ref. Fig. 401).

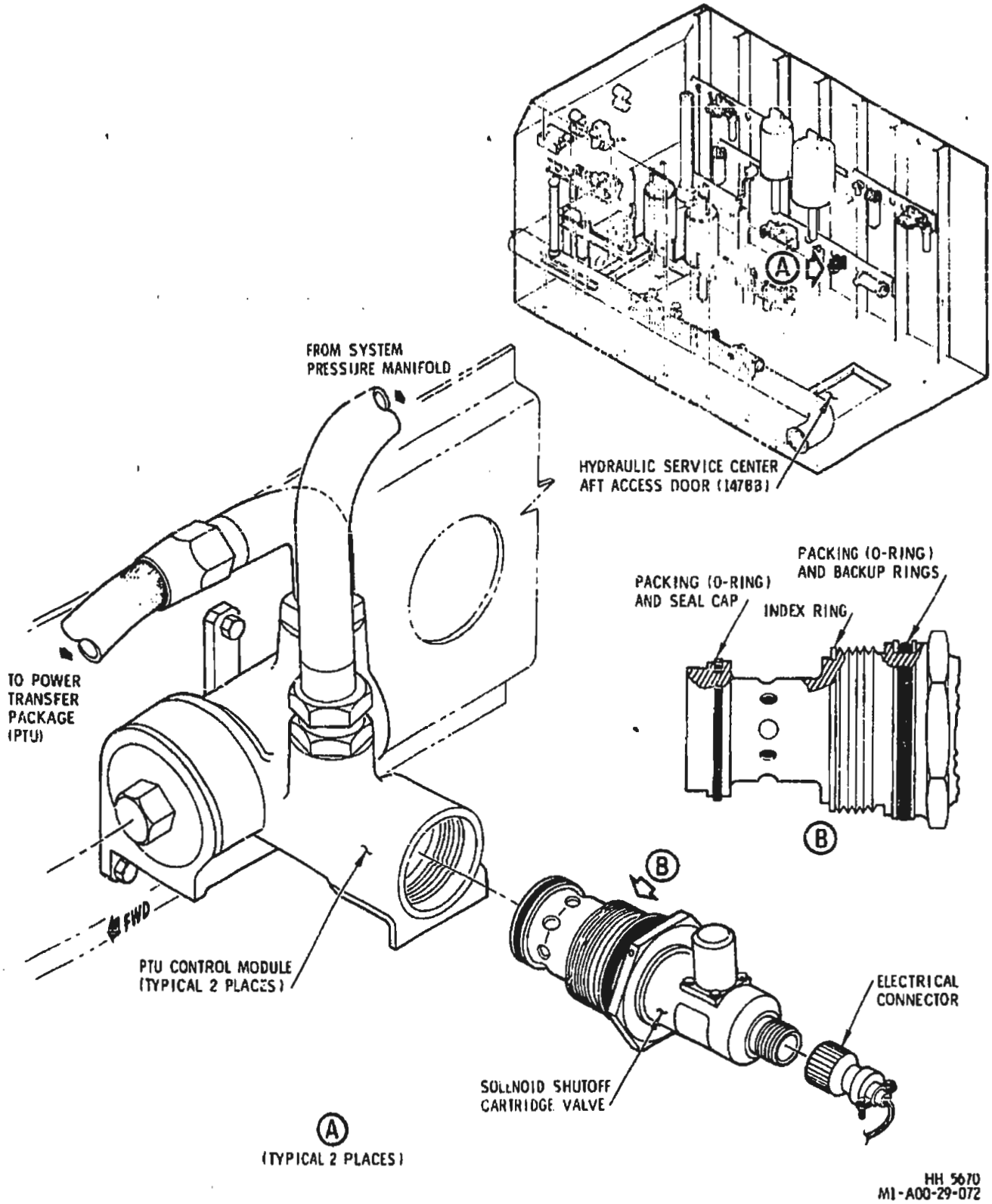
(4) Position container under PTU control module and remove shutoff valve from manifold.

(5) Cover cavity for protection from contamination if replacement valve is not to be installed immediately.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged, and check that:

(a) Manifold cavity and shutoff valve are clean



Power Transfer Unit Solenoid Shutoff Valve Removal and Installation Figure 401

(b) Shutoff valve packing O-rings and backup rings are in correct position

(c) Index ring is installed

R R (2) Install PTU shutoff valve in manifold, torque to 80 pound inches, and lock-wire.

(3) Connect electrical connector.

(4) Remove tag and close circuit breaker opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on electrical power (Ref. 24-41-00).

(6) Bleed the applicable hydraulic system as follows: (The controls and indicators are located on the HYDRAULIC SERVICE PANEL, zone 147.)

(a) Place applicable A.C. MOTOR PUMPS ON/OFF switch in the ON position.

(b) Place the applicable POWER TRANSFER UNIT (PTU) START/STOP momentary-type switch in the START position, and verify that the PTU operates (applicable indicator light comes on) and that there is no leakage. For B-A PTU only, operate the flaps through 1 cycle.

(c) Place the PTU START/STOP switch in the STOP position, and verify that the PTU operation stops (indicator light goes out).

(d) Place the A.C. MOTOR PUMPS ON/OFF switch in the OFF position.

(e) Perform reservoir AIR BLEED and AIR CHECK in accordance with the RESERVOIR SERVICE INSTRUCTIONS

placard replenish reservoir, as required (Ref. 12-13-01).

(7) Turn off electrical power (Ref. 24-41-00).

R (8) Close and lock service center access doors.

POWER TRANSFER UNIT FLOW REGULATOR VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3 gallons)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedure

R 12-13-01 Hydraulic Fluid Replenishing

24-41-00 External Power/Ground Service System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit
R breaker PTU CONT & IND SYS B or C (L14, 15), as applicable.

(2) Open service center access doors 147AB and 147EB.

NOTE: The PTU flow regulator valve cartridges are installed in the PTU control modules located on the left and right sidewalls below system B and C reservoirs. Removal and installation procedures are identical for each valve cartridge.

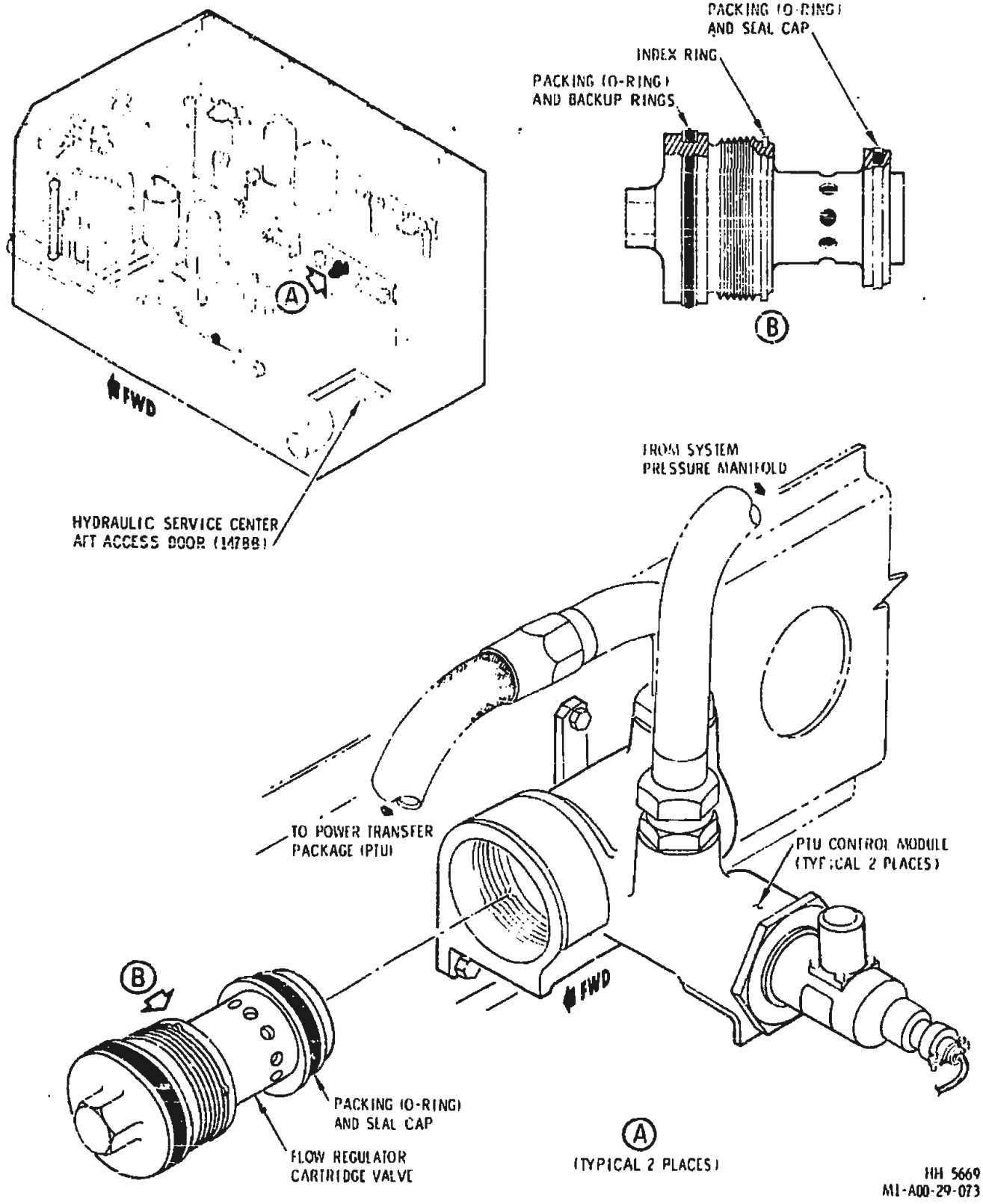
(3) Position container under PTU control module (Ref. Fig. 401) and remove flow regulator valve cartridge from manifold.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged, and check that:

(a) Manifold cavity and flow regulator valve cartridge are clean

(b) Valve cartridge packing O-rings and backup rings are installed



Power Transfer Unit Flow Regulator Valve Removal and Installation Figure 401

(c) Index ring is installed

(2) Install flow regulator valve in manifold cavity, torque CR to 150 pound inches and lock-wire.

(3) Remove tag and close circuit breaker opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREA.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on electrical power (Ref. 24-41-00).

(5) Pressurize and bleed the applicable hydraulic system as follows: (The controls and indicators are located on HYDRAULIC SERVICE PANEL, zone 147.)

(a) Place the applicable A.C. MOTOR PUMPS ON/OFF switch in the ON position.

(b) Place the applicable PTU START/STOP momentary-type switch in the START position and verify that the PTU operates (applicable indicator light comes on) and that there is no leakage.

(c) Place PTU START/STOP switch in STOP position, and verify that the PTU operation stops (indicator light goes out). For B-A PTU only, operate flaps through 1 cycle.

(d) Perform reservoir AIR BLEED and AIR CHECK in accordance with instructions on RESERVOIR SERVICE INSTRUCTIONS placard. Replenish reservoir if required (Ref. 12-13-01).

(e) Place the A.C. MOTOR PUMPS ON/OFF switch in the OFF position.

(6) Turn off electrical power (Ref. 24-41-00).

(7) Close and lock service center access doors.

R # AIR TURBINE MOTOR (ATM) - MAINTENANCE PRACTICES

R 1. General

R This procedure contains instructions for operating the air
R turbine motor (ATM).

R 2. Referenced Procedures

CR	12-12-61	Air Turbine Motor (ATM) - Lube Oil Servicing
R	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
R	24-00-00	Electrical Power - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices
R	36-13-00	High-pressure Ground Air System - Maintenance Practices
R	36-14-00	Pneumatic System Distribution - Maintenance Practices
R	49-00-01	Auxiliary Power Unit (APU) - Adjustment and Test

R 3. Operation

R A. Startup

R (1) Verify that applicable ATM lube oil level is in green
R range of sight glass (Ref. 12-12-61).

R (2) Turn on electrical power (Ref. 24-00-00).

R (3) Verify that applicable hydraulic system B or C
R reservoir is full (Ref. 12-13-01).

R (4) Connect external source of high-pressure air to center
R ground air connection (Ref. 36-13-00).

R NOTE: If a ground source of high-pressure air is not
R available, prepare to use the APU load
R compressor air as a source (Ref. 49-00-01).

R (5) Position pneumatic system distribution manifold
R controls, as required, to direct high-pressure air for
R ATM operation (Ref. 36-14-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, position applicable ATM selector to ON.

(7) Observe the following:

(a) ATM starts and runs continuously.

R R (b) ATM tachometer indicates between the mid to high yellow rpm range and the green rpm range.

(c) ATM HI TEM and LO PR lights are off.

B. Shutdown

(1) Position ATM selector to OFF.

(2) Shut off high-pressure air source (Ref. 36-13-00 or 49-00-01).

(3) Turn off electrical power (Ref. 24-00-00).

(4) Return pneumatic system distribution manifold controls to original positions as required (Ref. 36-14-00).

AIR TURBINE MOTOR (ATM) - SERVICING

1. Equipment and Materials

C Lubricating Oil, Exxon 2380 Turbo Oil

Acryloid Lubricant HF 825, Rohm and Haas, or Mobil Assembly Fluid

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Fill Plug packing (O-ring) M83248-1-904

Fill Screen packing (O-ring) M83248-1-906

Drain Plug packing (O-ring) M83248-1-905

Magnetic Plug packing (O-ring) M83248-1-902

Filter Bowl packing (O-ring) M83248-1-222

Filter Element packing (O-ring) M83248-1-114

Filter Element, 56032

Used oil container (1-gallon plastic pail or equivalent)

2. Referenced Procedures

C	12-12-61	Air Turbine Motor (ATM) - Lube Oil Servicing
R	29-11-39	Air Turbine Motor (ATM) - Inspection and Check

3. Servicing

A. Lube Oil and Filter Change

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker ATM PUMP CONT & IND SYS B (L13) or ATM PUMP COMT & IND SYS C (L19), as applicable.

(2) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, verify that ATM switches are in OFF position. Tag switches.

WARNING: RECENT OPERATION OF AIRCRAFT PNEUMATIC SYSTEM WILL REQUIRE PRECAUTIONS AGAINST DANGEROUSLY HIGH TEMPERATURES. PROTECTIVE GLOVES SHOULD BE USED WHEN REQUIRED.

(3) Remove access panel 195D for system B ATM or panel 196D for system C ATM, as applicable.

(4) On bottom of ATM gearbox near lube oil cooler, remove magnetic plug (Ref. Fig. 301). Inspect magnetic (chip detector) plug (Ref. 29-11-39, Inspection and Check).

(5) Remove self-closing valve and drain oil into a suitable container. Be prepared to catch approximately one quart of oil.

(6) Use new packings (O-rings) and reinstall the self-closing valve and the magnetic plug. Torque
R self-closing valve 30 to 40 lb in. and magnetic plug 15
R to 20 lb in. and lock-wire.

(7) Remove filter bowl and filter element.

(8) Thoroughly clean filter bowl assembly with clean lint-free cloths.

(9) Install new bowl and filter element packings lubricated with Acryloid or Mobil Assembly Fluid.

(10) Install new filter element and reinstall filter bowl;
R torque 75 to 85 lb in. and lock-wire.

(11) Replenish lube oil thru the accessible fill plug boss (Ref. 12-12-61).

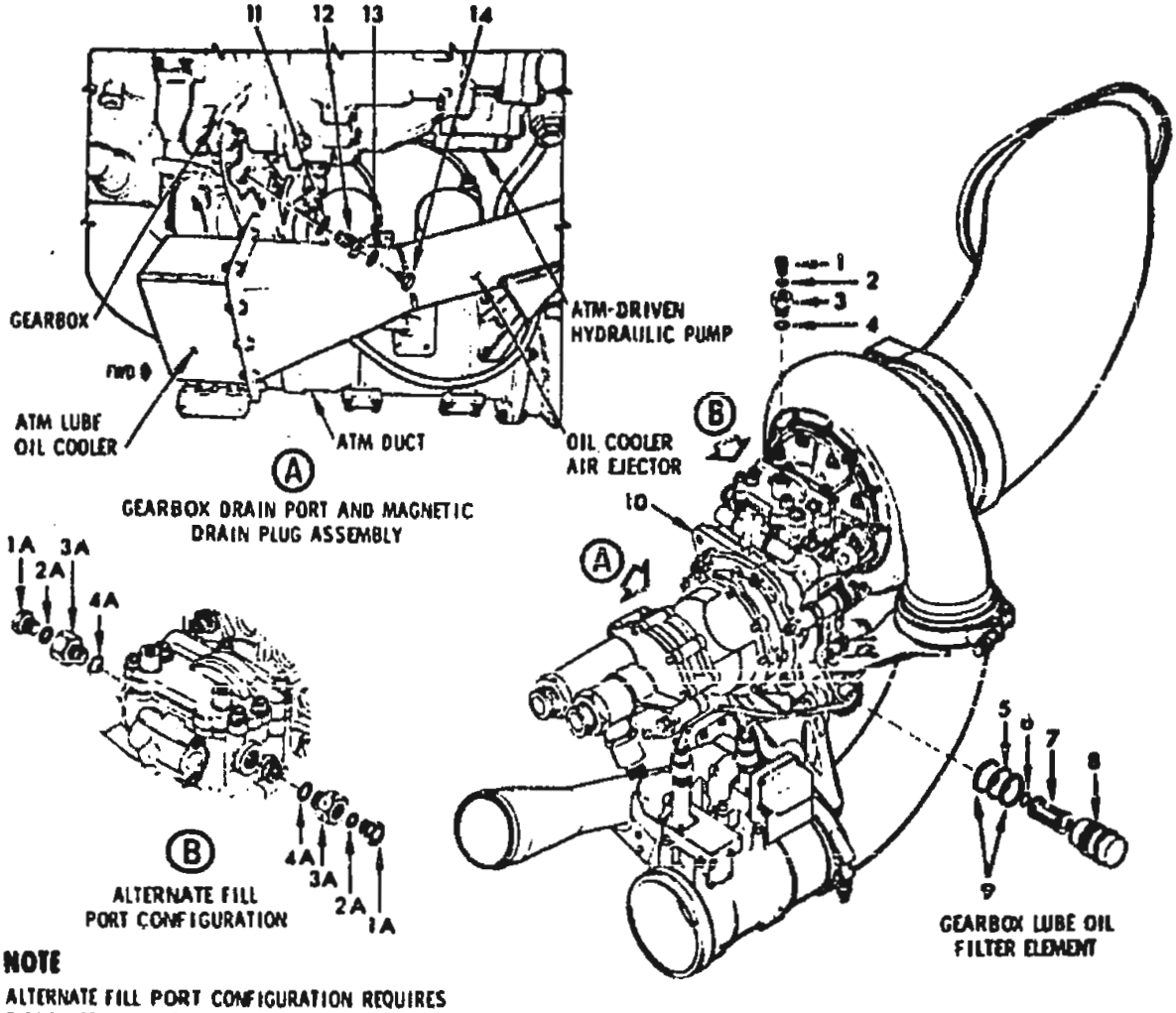
CAUTION: DO NOT OVERFILL OR DAMAGE MAY RESULT.

NOTE: If oil is above green band remove magnetic drain plug assembly and drain only enough oil to bring oil level into the FULL OIL LEVEL of the green area on sight glass gage.

(12) Reinstall access panels removed in Step 3A(3).

(13) Remove tag and close circuit breaker opened in Step 3A(1).

(14) Recheck oil level after initial ATM operation following oil and filter change (Ref. 12-12-61).



NOTE

ALTERNATE FILL PORT CONFIGURATION REQUIRES 2 EACH OF ITEMS 1A THRU 4A AS SHOWN

ITEM	NOMENCLATURE	PART NUMBER	INSTALLATION TORQUE (IN. LBS)
1	FILL PLUG		45-55
2	PACKING (O-RING)	M83248-1-904	
3	FILL SCREEN		75-100
4	PACKING (O-RING)	M83248-1-906	
5	FILTER BOWL PACKING (O-RING)	M83248-1-222	
6	FILTER ELEMENT PACKING (O-RING)	M83248-1-114	
7	FILTER ELEMENT	56032	
8	FILTER BOWL		75-85
9	BACK-UP RETAINER RINGS (2)	MS28774-22	
10	AIR TURBINE MOTOR (ATM)		
11	DRAIN PLUG PACKING (O-RING)	M83248-1-905	
12	SELF-CLOSING VALVE		30-40
13	MAGNETIC PLUG PACKING (O-RING)		
14	MAGNETIC PLUG		15-20

M1-0100-29-237

R
R

Air Turbine Motor (ATM) - Servicing
Figure 301

AIR TURBINE MOTOR - REMOVAL AND INSTALLATION

1. General

If the hydraulic pump requires maintenance, remove the pump (Ref. 29-11-71) before removing the air turbine motor (ATM). If pump does not require maintenance, disconnect pump from ATM and leave pump connected to aircraft hydraulic system. Position flaps to UP position to provide maximum access to work area.

If ATM is being replaced because of high oil consumption or failure of shaft bearing, exhaust duct should be replaced as heavy oil soak damage probably exists (Ref. 29-11-73).

CR Air Turbine Control Valves

CR A. Air control valves for the L-1011 air turbine motors exist CR in two lengths - a short valve and a long valve.

CR (1) Short Valve

CR (a) The short valve (Mfg. P/N 2690380M4, TWA Stk. Nbr. CR 273-6124) required use of an adapter assembly CR (Mfg. P/N 1561970-103,) between the valve and the CR bleed air duct. The adapter assembly consists of CR the following components:

		Mfg. P/N
CR Adapter	1 ea.	1558356-101
CR Retainers	4 ea.	1558357-101
CR Seal	1 ea.	MMM69056-353
CR Bolts	8 ea.	NAS6404U9
CR Washers	8 ea.	AN960C416L
CR Nuts	8 ea.	LH7875-4

CR (2) Long Valve

CR (a) The long valve Mfg. P/N 2720087, does not require CR the use of an adapter assembly.

CR (3) It is important that we return an adapter assembly to CR stock if it is not needed; therefore, when it is CR needed, it will be available.

2. Equipment and Materials

Fishpole Hoist (Ref. G/ITEL 49-00-06), or equivalent

Eyebolt, AN43B (1/4-28 UNF Thread), or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032 - inch diameter, or equivalent

Packing (O-ring), NAS 1593-216, no equivalent

Lubricant, Acryloid, HF825, Rohm and Haas, or Mobil Assembly Fluid

Rope (1/4 or 3/8 inch) or webbing strap (Nylon), or equivalent

3. Referenced Procedures

CR	12-12-61	Air Turbine Motor (ATM) - Lube Oil Servicing
	20-36-01	Single T-Bolt V-Band Coupling - Removal and Installation
	29-11-39	Air Turbine Motor - Adjustment and Test
	29-11-71	Air Turbine Motor-driven Hydraulic Pump - Removal and Installation
	29-11-73	Air Turbine Motor Exhaust Duct - Removal and Installation

4. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers ATM PUMP CONT & IND SYS B (L13), and ATM PUMP CONT & IND SYS C (L19).

(2) On Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215, check that ATM switches for system B and system C are in OFF position. Tag switches.

R WARNING: TAG FLIGHT ENGINEER/SECOND OFFICERS BLEED AIR AND APU CONTROL PANELS AND THE THREE HIGH-PRESSURE GROUND AIR CONNECTIONS TO PREVENT OPERATION UNTIL COMPLETION OF PROCEDURES. RECENT OPERATION OF AIRCRAFT PNEUMATIC SYSTEM WILL REQUIRE PRECAUTIONS AGAINST DANGEROUSLY HIGH SYSTEM TEMPERATURES. PROTECTIVE GLOVES SHOULD BE USED WHEN REQUIRED.

(3) Remove access panel 195D for system B ATM or panel 196D for system C ATM, as applicable.

(4) Disconnect electrical connector and pressure-sensing hose from ATM. Cap hose and ATM fitting (Ref. Fig. 401). On RH installation, remove electrical harness clips.

R CAUTION: USE EXTREME CARE TO PREVENT DAMAGE TO FIRE DETECTION CABLE ON BLEED AIR SUPPLY DUCT. DO NOT SUPPORT PUMP WEIGHT WITH HYDRAULIC HOSES. DO NOT BEND OR KINK HYDRAULIC HOSES.

(5) Before disconnecting hydraulic pump from ATM gearbox, provide support for pump with rope or webbing straps attached to aircraft structure above the pump and around the pump body, not to fittings or electrical connectors (Ref. Fig. 401).

(6) Loosen (do not remove) pump mounting nuts to permit rotation of pump on ATM gearbox mounting pad.

(7) Rotate pump clockwise until mounting nuts can pass through enlarged ends of mounting slots and remove pump from ATM. Do not disturb hydraulic hose connections. Pump weighs approximately 30 pounds. Secure the rope-supported or strap-supported pump [Step 4A(5)] clear of ATM.

(8) Remove and discard hydraulic pump coupling shaft packing.

(9) Loosen V-band coupling and safety latch (Ref. 20-36-01) from ATM exhaust duct assembly and ATM.

(10) Support exhaust duct assembly in such a manner that it will be displaced a minimum amount when ATM is removed.

(11) Loosen clamps on flexible hose connecting oil cooler duct and overboard duct to fairing-mounted exducer. Slide hose and clamps onto overboard duct to allow ATM removal.

NOTE: The ATM air control valve exist in two lengths: a short valve and a long valve. The long valve (Sundstrand Part No. 2720087) does not require the use of the adapter. The short valve (Sundstrand Part No. 2690380M4) requires use of an adapter assembly (Lockheed Part No. 1561970-103 left side, or 1562040-103 right side) between the valve and the bleed-air duct. Spare ATM's utilizing the short valve will normally be supplied with an adapter attached. The adapter assembly consists of the following:

ITEM	NUMBER	MFG. PART NO.	TWA STK. NO.
Adapter	1	1558356-101	None
Retainer	4	1558357-101	None
Seal	1	MMM69056-353	None
Bolt	8	NAS6404U9	32-3612
Washer	8	AN960C416L	43-0312
Nut	8	LH7875-4	70-0015

(12) Loosen and remove bleed air supply duct V-band coupling (Ref. 20-36-01).

(13) Attach fishpole hoist to aircraft structure hardpoint above ATM (Ref. Fig. 401).

(14) Screw eyebolt into inboard threaded boss on ATM gearbox top coverplate, and attach hoist cable to eyebolt.

(15) Apply lifting force with fishpole hoist to support weight of ATM.

(16) Remove ATM mounting bolts from support bracket assembly.

NOTE: Bushings in ATM mounting brackets may come out when mounting bolts are removed. Care must be exercized to ensure that bushings remain with mounting bracket for installation purposes.

R CAUTION: USE CARE TO PREVENT DAMAGE TO EXHAUST DUCT, AIR EJECTOR, AND AIR CONTROL VALVE DURING ATM REMOVAL.

(17) Lower ATM through access opening.

(18) Disconnect hoist cable from eyebolt. Remove eyebolt from ATM and remove hoist from aircraft.

(19) Inspect the exhaust duct for damage. Exhaust duct replacement (Ref. 29-11-73) is required if any of the following damage is found:

Holes or breaks in open weave inner liner

Separation of layers forming inner liner

Tears, creases, folds, or other obvious damage in surface of inner liner

Accumulation of oil in inner liner

Holes or breaks in outer surface just forward of duct bend

(20) Place protective covering over all ATM and aircraft duct openings, as required.

B. Installation

(1) Verify that circuit breakers opened in Step 4A(1) are open and tagged, and that switches tagged in OFF position in Step 4A(2) are as required.

(2) Remove protective coverings from all air supply and exhaust ducts, and inspect carefully for foreign objects.

(3) Install eyebolt in ATM coverplate threaded boss (Ref. Fig. 401).

(4) Attach fishpole hoist to aircraft structure hardpoint above ATM installation area, and attach hoist cable to ATM eyebolt.

CAUTION: USE CARE TO AVOID DAMAGING FIRE DETECTION LOOP CABLE ON BLEED AIR SUPPLY DUCT, EXHAUST DUCT, AIR EJECTOR, AND AIR CONTROL VALVE DURING ATM INSTALLATION.

(5) Hoist ATM into mounting position and install attaching bolts in ATM support bracket assembly. Verify that bushings are installed.

CR NOTE: Assure the straight bushing, shipped with unit,
CR is replaced by the shorter flanged bushing when
CR the lower strut is attached to the ATM.

(6) Disconnect hoist cable from eyebolt, and remove eyebolt from ATM and fishpole hoist from aircraft structure hardpoint.

(7) Install new packing on hydraulic pump coupling shaft. Lubricate packing with Acryloid or Mobil Assembly Fluid.

(8) Inspect pump mounting pad gasket for damage, and after inspection lubricate gasket with Acryloid or Mobil Assembly Fluid.

(9) Position pump in relation to ATM so that the least amount of side load is placed on pump hoses.

(10) Support the pump weight and release restraining ropes or straps.

R (11) With pump in horizontal position, engage coupling shaft splines with splines in ATM drive bushing.

R (12) Rotate pump assembly as required to permit pump mounting nuts to pass through pump mounting flange keyhole slots, and install pump against ATM mounting pad.

R (13) Rotate pump assembly counterclockwise until small ends of keyhole slots are firmly against ATM gearbox studs.

R (14) Tighten pump mounting nuts on studs.

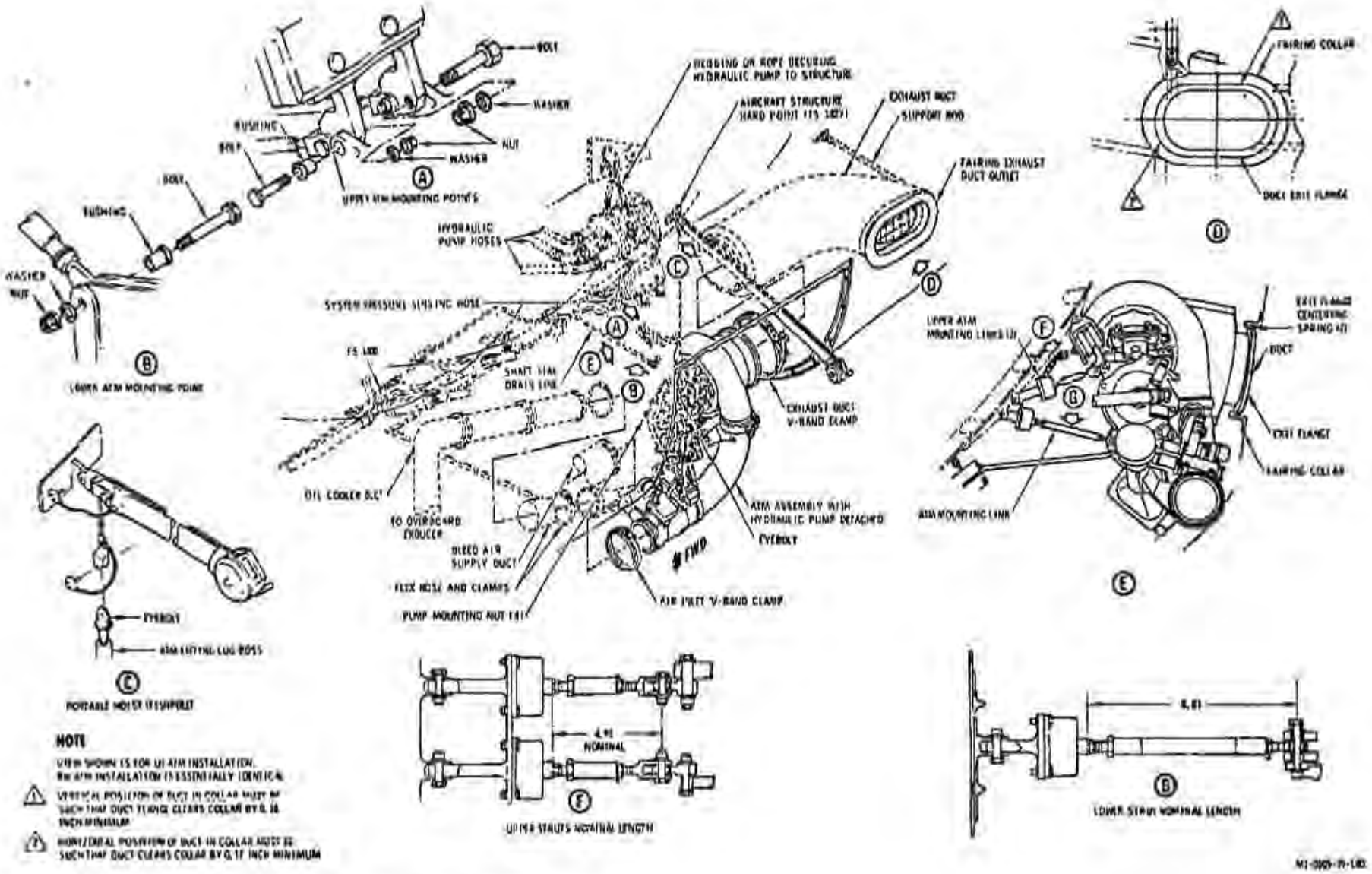
R (15) Center Exhaust Duct Exit Flange vertically, horizontally and longitudinally within the Exhaust Duct Fairing Collar. The Exhaust Duct Exit Flange must clear Exhaust Duct Fairing Collar by a minimum of 0.18 inch vertically and 0.12 inch horizontally.

R (16) Adjust the three ATM mounting links as required to align ATM with exhaust duct to place least amount of load on exhaust duct. Verify pump hoses are not under load.

R (17) Install bleed air supply duct V-band coupling (Ref. 20-36-01). Install adapter assembly as required.

R (18) Position flexible hose over duct beads of oil cooler and overboard duct, and position and tighten hose clamps.

R (19) Install ATM exhaust duct V-band coupling (Ref. 20-36-01) on ATM and exhaust duct flange.



R Air Turbine Motor - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
0018

AIR TURBINE MOTOR - ADJUSTMENT AND TEST

1. Equipment and Materials

Hydraulic ground test cart, B784C, or equivalent

Pneumatic High-pressure service cart, or equivalent.

2. Referenced Procedures

	12-12-61	Air Turbine Motor Servicing
R	12-13-01	Hydraulic Fluid Replenishing
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices
	36-13-00	High-pressure Ground Air System - Maintenance Practices
	36-14-00	Pneumatic System Distribution - Maintenance Practices
	49-00-01	Auxiliary Power Unit (APU) - Adjustment and Test

3. Adjustment/Test

A. Preparation for Test

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, close the following circuit breakers:

ATM PUMP CONT & IND SYS B (L13)

ATM PUMP CONT & IND SYS C (L19)

HYDRAULIC INDICATORS PRESS (M13)

(2) Verify that applicable ATM lube oil level is in green range of sight glass (Ref. 12-12-61).

(3) Turn on electrical power (Ref. 24-41-00).

(4) Verify that systems B and C hydraulic reservoirs are full (Ref. 12-13-01).

(5) Provide external hydraulic power for systems B and C ground test connections in hydraulic service center (Ref. 29-11-00).

NOTE: Preset the ground test cart controls to use the aircraft hydraulic reservoirs.

R AC pumps may be used for this test provided
R system pressure of 2800 psig minimum can be
R maintained. Shut off flight control servo units
R if required.

R (6) Provide external source of high pressure air 45±5 psig
R to the center ground air connection (Ref. 36-13-00).

R NOTE: If a ground source of high-pressure air is not
R available, prepare to use the APU load
R compressor air (Ref. 49-00-01). When using the
R APU as a pneumatic source, select Maximum Mode.

(7) Position pneumatic system distribution manifold controls as required to direct high-pressure air for ATM operation (Ref. 29-11-00 and 36-14-00).

(8) Perform ATM indicator lights test as follows:

(a) On Flight Engineer/Second Officers LIGHTS TEST panel, press the CAUTION ADVISORY LIGHTS test switch, verify that the ATM HI TEM LO PR lights come on.

(b) Verify that bleed air manifold pressure is zero. Position B2 and C2 ATM rotary selector switches to ON. Verify that PUMP OUTPUT LO PR lights come on.

(c) Position B2 and C2 ATM selector switches to OFF and verify that PUMP OUTPUT LO PR lights go out.

R B. ATM Operational/Test (Using Hydraulic Ground Test cart)

The following procedure tests the operation of the B2 or C2 ATM. Operate the applicable ATM and hydraulic system controls for the following test.

(1) Turn on high-pressure air source or APU, as applicable, to pressurize the pneumatic distribution manifold for the ATM being tested (Ref. 36-13-00, 36-14-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE

THE ATM EXHAUST AREA IS CLEAR OF PERSONNEL AND EQUIPMENT.

(2) Turn on hydraulic ground test cart and verify that system B or C, as applicable is pressurized to 3000 (±50) psig (Ref. 29-11-00).

(3) On HYDRAULIC SYSTEM panel, zone 215, position the applicable ATM selector to AUTO and verify that the ATM does not operate.

(4) Operate the hydraulic ground test cart controls to slowly decrease applicable system B or C pressure until ATM pump starts to operate; observe the following:

(a) ATM operation begins when hydraulic system pressure decays to 2600 (±50) psig.

(b) ATM pump CASE DRAIN HI TEM light remains out.

(c) ATM PUMP OUTPUT LO PR light remains out.

(d) ATM (LUBE) HI TEM and LO PR lights remain out.

R R (e) The ATM tachometer indicates between the mid to high yellow range and the green range.

(5) Verify that the ATM pump automatically cycles off 15 to 20 seconds after system pressure reaches approximately 2850 psig.

(6) While the ATM is automatically cycled off, position the ATM selector to ON and observe the following:

NOTE: The ATM selector switch is easily rotated beyond the ON position to the OVSP TEST position, causing the ATM to stop. Should this happen, reposition selector to OFF and recycle the applicable circuit breaker open and reset.

(a) The ATM starts and runs continuously.

R (b) The ATM tachometer indicates between the mid to
R high yellow range and the green range.

(c) The ATM HI TEM and LO PR lights are out.

B. ATM Operational/Test (Using Aircraft AC Motor Driven Hydraulic Pumps)

The following procedure tests the operation of the B2 or C2 ATM. Operate the applicable ATM and hydraulic system controls for the following test. AC pumps may be used provided a system of 2800 psig minimum can be maintained. Shut off flight control servo units if required.

(1) Turn on high-pressure air source or APU, as applicable, to pressurize the pneumatic distribution manifold for the ATM being tested (Ref. 36-13-00, 36-14-00).

NOTE: External source of high-pressure air should be at 45(±5) psig. If APU is used, select maximum mode.

CAUTION: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

THE ATM EXHAUST AREA IS CLEAR OF PERSONNEL AND EQUIPMENT.

(2) Turn on electric pump and verify that system B or C, as applicable is pressurized to 2800 psig minimum (Ref. 29-11-00).

(3) On HYDRAULIC SYSTEM panel, zone 215, position the applicable ATM selector to AUTO and verify that the ATM does not operate.

(4) Shut off (unlatch) the AC pump switchlight; observe the following:

(a) ATM operation begins when hydraulic system pressure decays to 2600 (±50) psig.

(b) ATM pump CASE DRAIN HI TEM light remains out.

(c) ATM PUMP OUTPUT LO PR light remains out.

NOTE: May come on momentarily but must go out and remain out.

(d) ATM (LUBE) HI TEM and LO PR lights remain out.

(e) The ATM tachometer indicates between the mid to high yellow range and the green range.

(5) Turn the AC pump back on and verify that the ATM pump automatically cycles off 15 to 20 seconds after system pressure reaches approximately 2850 psig.

(6) While the ATM is automatically cycled off, position the ATM selector to ON and observe the following:

NOTE: The ATM selector switch is easily rotated beyond the ON position to the OVSP TEST position, causing the ATM to stop. Should this happen, reposition selector to OFF and recycle the applicable circuit breaker open and reset.

(a) The ATM starts and runs continuously.

(b) The ATM tachometer indicates between the mid to high yellow range and the green range.

(c) The ATM HI TEM and LO PR lights are out.

C. ATM Overspeed Protection System Operational Check

NOTE: The ATM Controller has a safety circuit added to initiate shutdown if the overspeed safety monitor is lost.

R

Before performing overspeed check, reference Para A and B for test preparation and ATM operation.

(1) With the applicable ATM operating in the ON position, rotate selector to OVSP TEST and observe the following:

(a) ATM tachometer needle moves into red zone and the ATM stops.

NOTE: The ATM tachometer needle will move into the red area indicating an overspeed, and

then go toward zero rpm as the ATM stops. The overspeed indication is a simulated overspeed signal in the control circuit, not an actual air turbine overspeed.

(2) On aircraft 001-023 without SB 29-047, position ATM selector to OFF; recycle circuit breakers ATM PUMP CONT & IND SYS B (L13) and SYS C (L19) to open and reset.

(2) On aircraft 001-023 with SB 29-047, and 024-999, position ATM selector to OFF.

(3) Reposition selector to ON and verify that the ATM operates.

(4) Position ATM selector to OFF and verify that the ATM stops.

D. Test Completion

(1) Shut off hydraulic ground test cart and disconnect hoses from ground service connections (Ref. 29-11-00).

(2) Shut off high-pressure air source, as applicable (Ref. 36-13-00, 49-00-01).

(3) Turn off electrical power if no longer required (Ref. 24-41-00).

(4) Close and lock hydraulic service center access doors.

R 4. Safety Check

R A. Lost Overspeed Signal Safety Check

R (1) Prepare aircraft for check in accordance with Paragraph
R 3A.

R (2) On Flight Engineer/Second Officers HYDRAULIC SYSTEM
R panel, verify ATM control switches are in the OFF
R position and ATM tachometers indicate zero RPM.

R NOTE: Perform the following Steps for one ATM at a
R time. Repeat Steps for other ATM.

R It is important that ATM control switches be
R moved quickly to the required settings without
R overshooting.

R (3) Position the ATM switch quickly to the OVSP TEST
R position then immediately to the ON position. Verify
R ATM does not start.

R NOTE: If the ATM starts or attemps to start and then
R shuts down, as indicated by the ATM tachometer,
R the test must be repeated.

R (4) Reset ATM controller by placing the ATM control switch
R to the OFF position.

R (5) Return aircraft to service in accordance with Paragraph
R 3D.

AIR TURBINE MOTOR (ATM) - INSPECTION AND CHECK

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

R Packing seal (o-ring), M83248-1-905

2. Referenced Procedure

6-40-00 Exterior Access Doors and Panels

R 12-12-61 Air Turbine Motor (ATM) - Servicing

3. Inspection/Check

A. ATM Gearbox Magnetic Chip Detector Plug Check

(1) Remove access panel 195D for system B ATM or panel 196D for system C ATM, as applicable (Ref. 6-40-00).

(2) Locate magnetic chip detector plug (Ref. Fig. 601) at bottom of gearbox on side of ATM near lube oil cooler and close to hydraulic pump shaft seal overboard drain line.

R (3) Remove magnetic plug from the self-closing valve.

R R NOTE: The self-closing valve will prevent oil from draining from gearbox when magnetic plug is removed.

(4) Inspect the magnetic plug in accordance with condition inspection data (Ref. Fig. 601).

R NOTE: If inspection indicates that the ATM is to be removed from service and sent to the overhaul facility, do not clean the magnetic plug. The condition indication on the plug may be useful in determining the internal condition of the unit and the cause of the damage.

(5) If inspection indicates that the ATM is in serviceable condition proceed as follows:

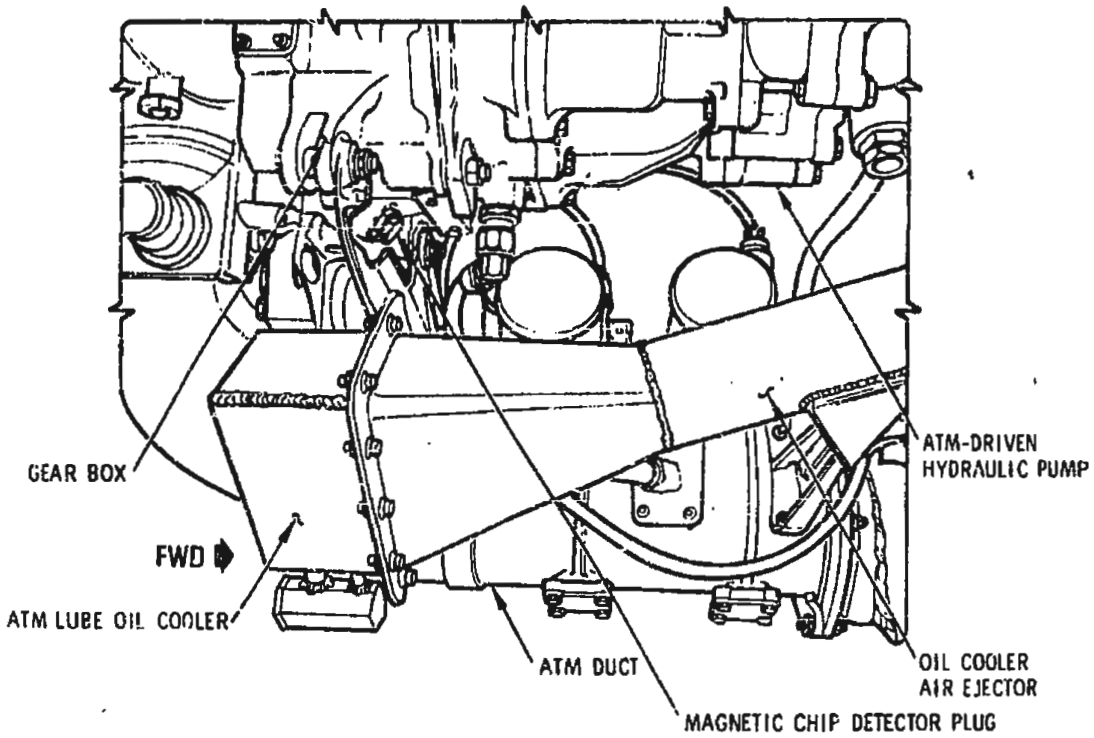
R R (a) Clean the magnetic plug thoroughly of all deposits.

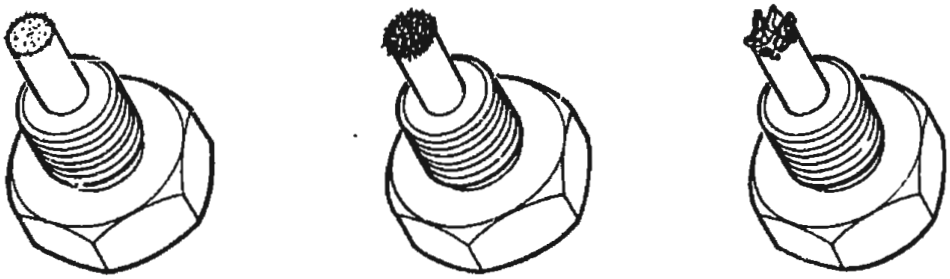
R (b) Use new O-ring and install plug in self-closing
R valve, torque magnetic plug 15-20 inch pounds.

R (c) Lock-wire magnetic plug to self-closing valve.

R (d) Check ATM gearbox lube oil level and service if
R required (Ref. 12-12-61).

(6) Close access panel opened in Step 3A(1) (Ref. 6-40-C0).





INSPECTION OF THE MAGNETIC CHIP DETECTOR PLUG	
CONDITION	DESCRIPTION AND PROCEDURE
1	A SMALL AMOUNT OF FINE GRANULAR MATERIAL OR FUZZ AS ILLUSTRATED IN CONDITION 1, IS NORMAL. CLEAN AND REINSTALL MAGNETIC CHIP DETECTOR PLUG.
2	IF HEAVY DEPOSITS OF FUZZ ARE PRESENT AS ILLUSTRATED IN CONDITION 2, AND IF ATM HAS BEEN OPERATING NORMALLY, CLEAN AND REINSTALL THE MAGNETIC CHIP DETECTOR PLUG.
3	IF CHUNKS OF METAL OR DEPOSITS CLEARLY DEFINABLE AS BEING CAUSED BY BREAKAGE AS ILLUSTRATED IN CONDITION 3 ARE FOUND ON THE MAGNETIC CHIP DETECTOR PLUG, REMOVE THE ATM ACCORDING TO PROCEDURES IN REMOVAL/INSTALLATION AND SEND TO THE OVERHAUL FACILITY. BRIGHT METAL DEPOSITS ARE AN INDICATION OF POSSIBLE INTERNAL FAILURE. DO NOT CLEAN THE MAGNETIC CHIP DETECTOR PLUG.

HA 0706 M1-0100-29-172

ATM Gearbox Magnetic Chip Detector Plug - Inspection and Check
Figure 601

AIR TURBINE MOTOR CONTROLLER - REMOVAL AND INSTALLATION

1. Referenced Procedures

	20-24-04	Electric Bonding and Grounding Connections - LCP84-1027B
	29-11-39	Air Turbine Motor - Adjustment and Test
R R	33-17-04	Indicator Lights Control Box - Removal and Installation

2. Removal/Installation

A. Removal

NOTE: Before replacing a new controller because of an inoperative air turbine motor, the lubrication low pressure switch must be checked for short to ground to prevent replacement controller power supply burnout. Proceed as follows:

R R R Remove cards 1A3 and 1A10 from the Indicator Lights Control Box (ILCB) located in the Forward Electronics Service Center, Zone 113 (Ref. 33-17-04).

For B system ATM, check switch connector pin 37 for continuity to ground.

For C system ATM, check pin 13.

R Replace ILCB cards.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers ATM PUMP CONT & IND SYS B (L13) or C (L19).

(2) Beneath equipment rack on mid electrical service center (MESC), zone 134, aft bulkhead, right side, remove ATM controller as follows (Ref. Fig. 401):

(a) Disconnect electrical connector.

(b) Remove screws securing controller to mounting brackets.

(c) Remove controller.

B. Installation

(1) Verify chat circuit breakers opened in Step A(1) are open and tagged.

(2) Beneath equipment rack on mid electrical service center, zone 134, aft bulkhead, right side, install ATM controller as follows:

(a) Position ATM controller on brackets and secure with screws (Ref. 20-24-04).

(b) Connect electrical connector.

(c) Perform ATM adjustment and test (Ref. 29-11-39).

NOTE: The ATM and ATM controller are integrally connected functionally. In order to perform an operational test, it is necessary to complete the entire adjustment and test procedure (Ref. 29-11-39).

C 3. ATM Controller Modification

C A. The ATM Controller, contains two identical sections. One C section is for the B hydraulic system ATM, the other is for C the C system ATM. The two sections connect through a single C connector. A second connector has been added in parallel C with the normal connector, but the second connector has the C connections to the B and C sections reversed.

C B. If the C section of the controller fails, the reversing C connector labeled REV can be used. This connects the C ATM C to the B section of the CONTROLLER, thus making the C ATM C operative as required for dispatch.

C C. In addition, the controller sections can be reversed for C troubleshooting. If one ATM is inoperative try the other C controller section to confirm a failure.

C D. The two connectors are labeled NORM for normal, and REV for C reversed. Although either connector can be used, connection C should be made routinely to the NORMAL connector. The C plastic cap should be left on the unused connector as there C is voltage on some of the exposed pins.

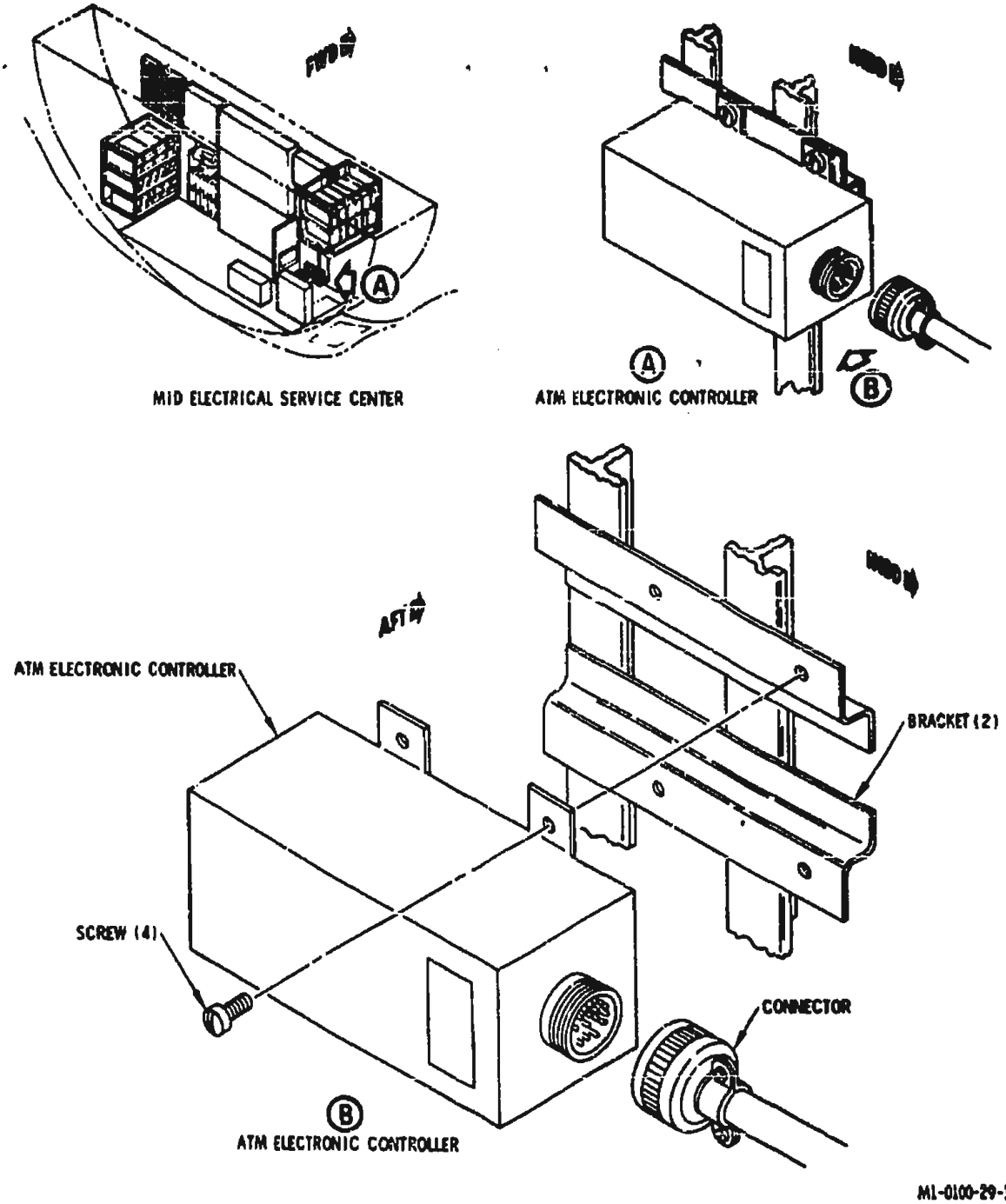
C E. Most problems in the ATM system fit one of the categories C listed in Table 401. Most likely causes are also shown. C For more detailed information, refer to the Firm or C Maintenance Manual, Chapter/Section 29-11-00.

C ATM PROBLEM HISTORY
C TABLE 401

PROBLEM	MOST PROBABLE CAUSE	POSSIBLE CAUSE
OVERSPEED TRIP	VALVE	CONTROLLER
INOP IN AUTO ONLY	BUS PRESSURE SW.	CONTROLLER
WILL NOT START OR RUN	ATM TURBINE WHEEL BURST	CONTROLLER
	SHORTED LUBE LO PRESS SW. THIS BURNS OUT CONTROLLER	VALVE
ATM LUBE LO PRESS	OIL LEVEL LOW	SWITCH
	ATM PUMP DRIVE SHEARED	ILCB CARD[1]
ATM LUBE HI TEMP	OIL COOLER AIR INLET CLOGGED	SWITCH (P/O HARNESS)
		ILCB CARD[1]

NOTE: STOCK NUMBERS ARE SHOWN WHERE APPLICABLE

[1]ILCB CARD J110 (1A10) APPLICABLE TO BOTH B AND C SYSTEMS



CR ATM Controller - Removal and Installation
CR Figure 401

R EFFECTIVITY: ALL
R
001R

HYDRAULIC PUMP DEPRESSURIZATION SOLENOID VALVE REMOVAL AND INSTALLATION

1. General

R Hydraulic pump solenoid depressurizing valves are installed on each engine-driven and ATM-driven pump. (Solenoid valves are installed on the ATM-driven pumps but are not connected electrically; protective caps are installed on the electrical connectors).

R Removal and installation of depressurization solenoid valves on all engine-driven pumps is the same except for access and circuit breaker numbers.

R 2. Equipment and Materials

R Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

R Lock-wire, Corrosion Resistant Round Steel Wire, Type 302, Size 0.032 inch (0.80mm)

R Waste Fluid Container, plastic pail, or equivalent

R 3. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	12-13-01	Hydraulic Fluid Replenishing
R	24-41-00	External Power/Ground Service System - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices
R	71-00-00	Power Plant - Maintenance Practices

R 4. Removal/Installation

R A. Removal

R WARNING: VERIFY APPLICABLE HYDRAULIC SYSTEM IS SHUT OFF AND TAGGED AGAINST OPERATION AND THAT ACCUMULATOR IS DEPRESSURIZED PRIOR TO LOOSENING ANY HYDRAULIC LINE OR COMPONENT.

R (1) Verify applicable hydraulic system and reservoir pressures are zero psi (Ref. 29-11-00) and tag hydraulic control panels against operation.

R (2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable system circuit breakers as follows:

R HYD PUMP & SHUTOFF VALVE CONT

R SYS A (L15)

R SYS B (L16)

R SYS C (L17)

R SYS D (L18)

R (3) Open access panels (Ref. 6-40-00) as follows:

R System A (Engine 1) 413 and 414

R Systems B and C (Engine 2) 433 and 434

R System D (Engine 3) 423 and 424

R (4) Disconnect electrical connector from solenoid valve (Ref. Fig 401).

R (5) Cut and remove lock-wires between solenoid valve and pump body.

R (6) Place waste fluid container under pump; loosen solenoid valve and remove from pump body. Hydraulic fluid may drain from pump body.

R B. Installation

R (1) Verify hydraulic system panels are tagged against operation.

R (2) Verify applicable HYD PUMP & FIREWALL SHUTOFF VALVE CONT (L15-L18) circuit breaker remains open and tagged.

R (3) Verify pump cavity is clean and free of contamination.

R (4) Coat packings in clean hydraulic fluid and install, in proper sequence, three packings and two backup rings on solenoid valve (Ref. Fig. 401).

R (5) Install solenoid valve in pump body cavity. Ensure packings and backup rings are not displaced or damaged.

R (6) Torque solenoid valve to 225 to 250 lb in. and install
R lock-wire.

R (7) Connect electrical connector to solenoid valve and
R install lock-wire.

R (8) On pilots overhead circuit breaker panel CB1, zone 210,
R remove tag and close applicable system HYD PUMP &
R FIREWALL SHUTOFF VALVE CONT (L15-L18).

R (9) Turn on electrical power (Ref. 24-41-00).

R (10) While listening and feeling solenoid valve body, signal
R a cockpit crew member to operate the applicable PUMP
R S/O switchlight on and off; verify operation of the
R valve.

R NOTE: Solenoid is de-energized when hydraulic system
R panel switchlight is depressed (latched) and
R energized when the switchlight is released
R (out). An audible click may be heard when the
R solenoid actuates and an increase in solenoid
R case temperature may be detected by hand contact
R when the solenoid is energized.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R LANDING GEAR DOWNLOCK PINS AND DOOR SAFETY DEVICES
R ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (11) On Flight Engineer/Second Officers hydraulic system
R panel, depress (latch) applicable AC MOTOR PUMP and PTU
R switchlights as required to pressurize the hydraulic
R systems (Ref. 29-11-00). All four hydraulic system
R reservoirs should be pressurized.

R (11) Depress (latch) applicable PUMP S/O switchlight
R (flowbar on).

R (12) Motor the applicable engine (Ref. 71-00-00) to operate
R the engine-driven pump.

R (13) Release (out) AC MOTOR PUMP & PTU switchlights (flowbar
R out) and verify system pressure is maintained by
R engine-driven pump.

R (14) Release (out) PUMP S/O switchlight (flowbar out).
R Verify hydraulic system pressure decays toward zero.

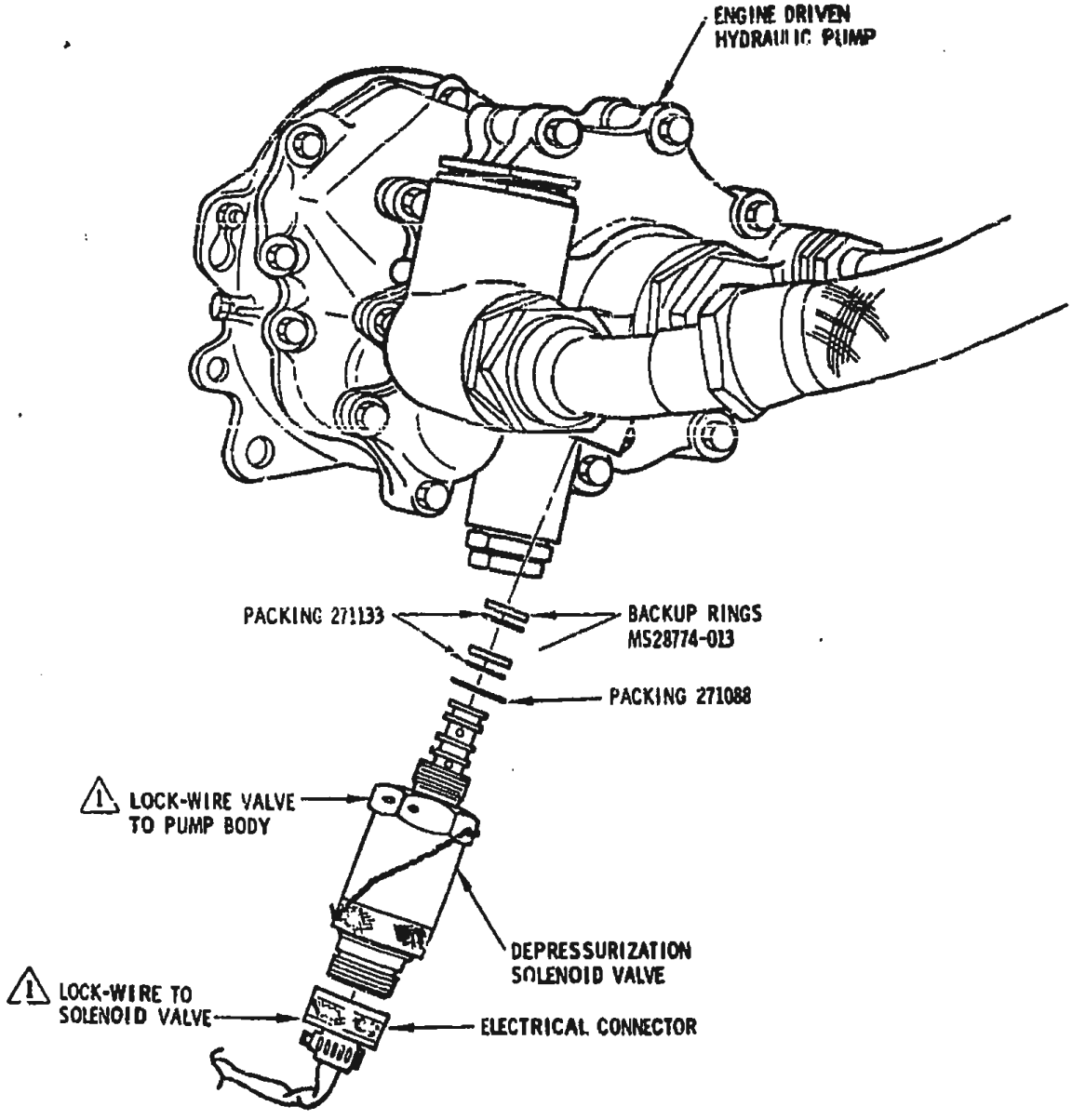
R (15) Stop motoring engine (Ref. 71-00-00).

R (16) Check depressurization solenoid valve for signs of
R leakage.

R (17) Perform hydraulic reservoir AIR CHECK and reservoir AIR
R BLEED on applicable reservoir in accordance with
R instructions on HYDRAULIC SERVICE PANEL and RESERVOIR
R SERVICE INSTRUCTIONS placards, in Hydraulic Service
R Center, Zone 147.

R (18) Turn off electrical power.

R (19) Close and lock cowl panels.



MI-0100-29-357

R Hydraulic Pump Depressurization Solenoid Valve
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

ATM AIR CONTROL VALVE ASSEMBLY - REMOVAL AND INSTALLATION

R 1. General

CR A. Air control valve s for the L-1011 air turbine motors exist CR in two lengths - a short valve and a long valve.

CR (1) Short Valve

CR (a) The short valve (Mfg. P/N 2690380M4,) requires use CR of an adapter assembly (Mfg. P/N 1561970-103,) CR between the valve and the bleed air duct. The CR adapter assembly consists of the following CR components:

		Mfg. P/N
Adapter	1 ea.	1558356-101
Retainers	4 ea.	1558357-101
Seal	1 ea.	MMM69056-353
Bolts	8 ea.	NAS6404U9
Washers	8 ea.	AN960C416L
Nuts	8 ea.	LH7875-4

CR (2) Long Valve

CR (a) The long valve (Mfg. P/N 2720087) does not require CR the use of an adapter assembly.

CR (3) It is important to return an adapter assembly to stock CR if it is not needed; therefore, when it is needed, it CR will be available.

R 2. Referenced Procedures

20-36-01 Single T-bolt V-band Coupling - Removal and Installation

29-11-39 Air Turbine Motor - Adjustment and Test

R 3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit

breakers ATM CONT PWR, ATM CONT & IND SYS B, and ATM CONT & IND SYS C.

(2) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, tag applicable ATM control switch in OFF position.

R WARNING: TAG FLIGHT ENGINEER/SECOND OFFICERS BLEED AIR AND APU CONTROL PANELS AND THE THREE HIGH-PRESSURE GROUND AIR CONNECTIONS TO PREVENT OPERATION UNTIL COMPLETION OF PROCEDURES. RECENT OPERATION OF AIRCRAFT PNEUMATIC SYSTEM WILL REQUIRE PRECAUTIONS AGAINST DANGEROUSLY HIGH SYSTEM TEMPERATURES. PROTECTIVE GLOVES SHOULD BE USED WHEN REQUIRED.

(3) Remove access panel 195D for system B ATM, or panel 196D for system C ATM.

(4) Disconnect electrical connectors from control valves (Ref. Fig. 401).

R CAUTION: USE EXTREME CARE TO PREVENT DAMAGE TO FIRE DETECTION LOOP CABLE ON BLEED AIR SUPPLY DUCT.

(5) Remove capscrews attaching air ejector tube and cooler duct bracket to air control valve assembly.

(6) Loosen and remove V-band coupling and safety latch (Ref. 20-36-01) from each end of air control valve.

(7) Remove air control valve assembly from ATM.

B. Installation

R (1) Verify that circuit breakers opened in 3A(1) are open
R and tagged and that switches tagged in OFF position in
R Step 3A(2) are as required.

R CAUTION: USE CARE TO AVOID DAMAGING FIRE DETECTION LOOP CABLE.

(2) Position air control valve in place, and install bleed air supply duct V-band coupling at each end of air control valve (Ref. 20-36-01).

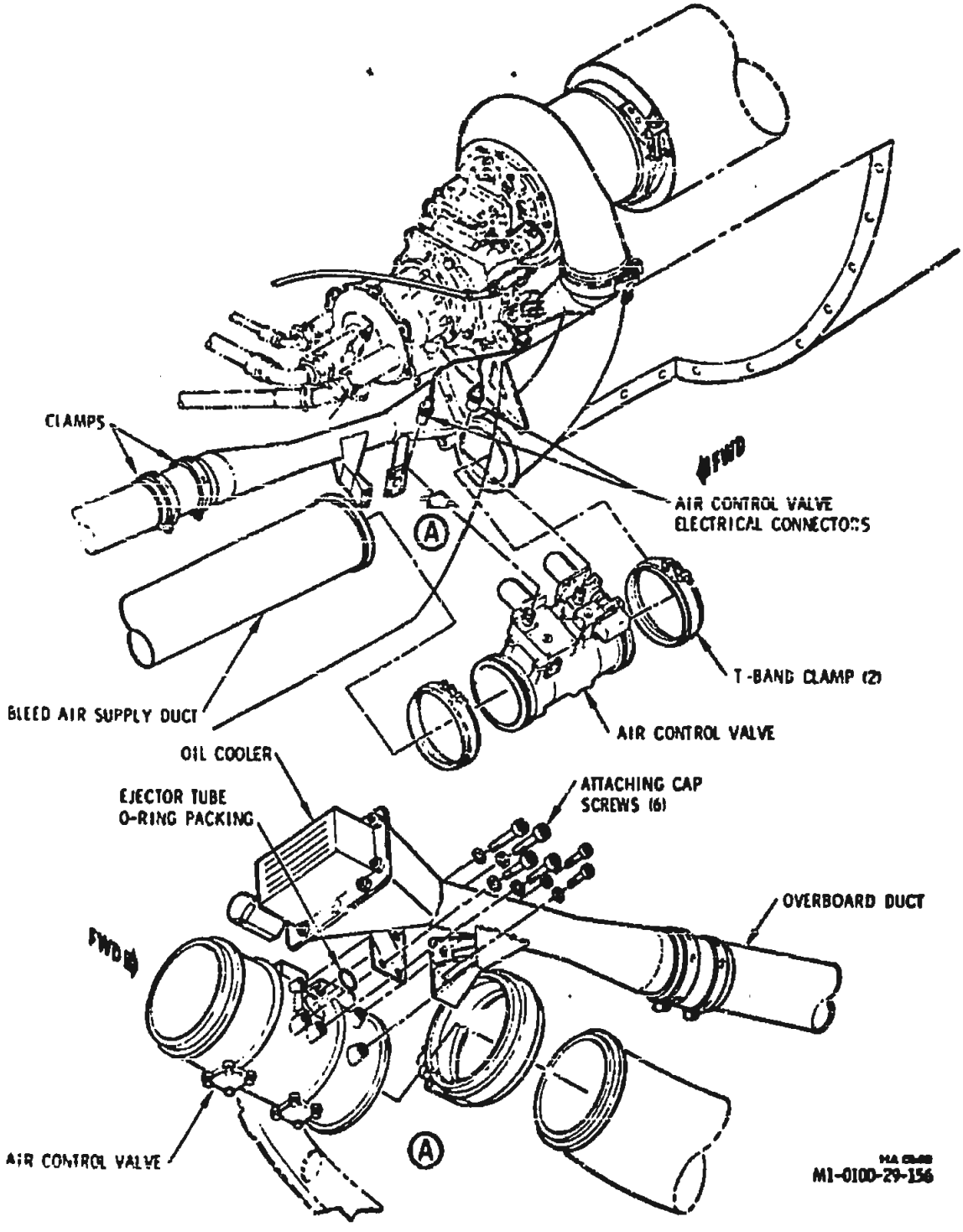
NOTE: The ATM air control valve comes in two lengths; a long valve and a short valve, the short valve (Sunstrand Part No. 2690380M4) requires the use of an adapter assembly (Ref. 29-11-39).

(3) Install capscrews attaching air ejector tube and cooler duct attaching bracket to air control valve assembly.

(4) Connect electrical harness to air control valve plugs.

R R R (5) Remove tags and close circuit breakers opened in Step 3A(1), and remove tags from HYDRAULIC SYSTEM control panel switches [Ref. Step 3A(2)].

(6) Test operation of air turbine motor (Ref. 29-11-39).



ATM Air Control Valve - Removal and Installation
Figure 401

AIR_TURBINE_MOTOR_DRIVEN_PUMP_-_MAINTENANCE_PRACTICES

1. Deactivation

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

A. Hydraulic Pump B2 or C2

(1) On Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215, rotate ATM B2 or C2 switch to OFF.

CAUTION: THE FLIGHT ENGINEER/SECOND OFFICERS OVERHEAD CIRCUIT BREAKER PANEL CB2 - ATM PUMP CONT & IND SYS B (L13) - CIRCUIT BREAKER SUPPLIES ELECTRICAL POWER TO THE PORTION OF THE INDICATOR LIGHTS CONTROL BOX CARD 1A3 WHICH TURNS ON THE MASTER CAUTION AND WARNING-HYDRAULIC SYSTEM-LIGHT. THEREFORE, IF (L13) IS OPENED TO DEACTIVATE THE B2 PUMP ATM, A FAULT IN ANY HYDRAULIC SYSTEM WOULD NOT BE INDICATED ON THE MASTER CAUTION AND WARNING PANEL.

DO NOT OPEN CIRCUIT BREAKER - ATM PUMP CONT & IND SYS B (L13).

(2) Place INOPERATIVE placard on HYDRAULIC SYSTEM control panel for inoperative pump.

(3) Make appropriate entry in aircraft log book.

AIR TURBINE MOTOR-DRIVEN HYDRAULIC PUMP - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3 gallons)

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Hydraulic Service Dolly (Ref. ITEL 12-13-03), or equivalent

Protective caps and plugs, LS12995-4, -8, -16, and -20, or equivalent

Gaskets (O-rings), NAS 1612-4, -8, -16, and -20, (pump port adapter fitting seals) M83248/1-216 and NAS1611-119 (coupling shaft seals), or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

NOTE: When a hydraulic pump is replaced and the case drain filter for that pump shows signs of contamination, the related main hydraulic supply system must be checked and flushed if system contamination is detected.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers ATM PUMP CONT & IND SYSTEM B or C (L13), (L19), as applicable, and AC PUMP B3 or C3 (L12), (L22), as applicable.

(2) Remove access panel 195D for system B (LH MLG FUS fairing) or 196D for system C (RH MLG FUS fairing), as applicable.

R R R R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF. 29-11-00, 201).

(3) Protect the ATM air control valves and air supply line from fluid spillage (Ref. Fig. 401). Position container to catch fluid drainage from hydraulic lines (Ref. Fig. 401). Disconnect hydraulic lines from hydraulic pump. Secure lines to upper brackets to provide clearance for pump removal.

(4) Place protective plugs and caps on all disconnected lines and fittings.

(5) Loosen (do not remove) pump mounting nuts to permit rotation of pump on gearbox mounting pad.

(6) Rotate pump clockwise until mounting nuts can pass through enlarged ends of pump mounting slots, and remove pump from gearbox (pump weighs approximately 30 pounds).

(7) Cover ATM gearbox mounting pad with protective cover if replacement pump is not to be installed immediately.

(8) Remove adapter fittings from pump that are to be used on replacement pump. Discard packing O-rings.

(9) Place protective plugs in pump pressure, suction, and case drain ports.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged, and check that:

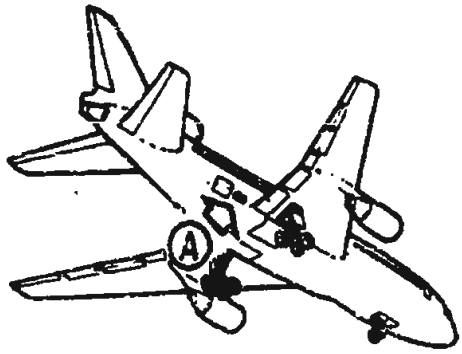
(a) ATM gearbox pump mounting pad and pump mounting flange surfaces are clean

(b) Pump coupling shaft seal packing (O-ring) is installed and lubricated with engine oil

(c) Mounting gasket is in good condition and is lubricated with engine oil before installation

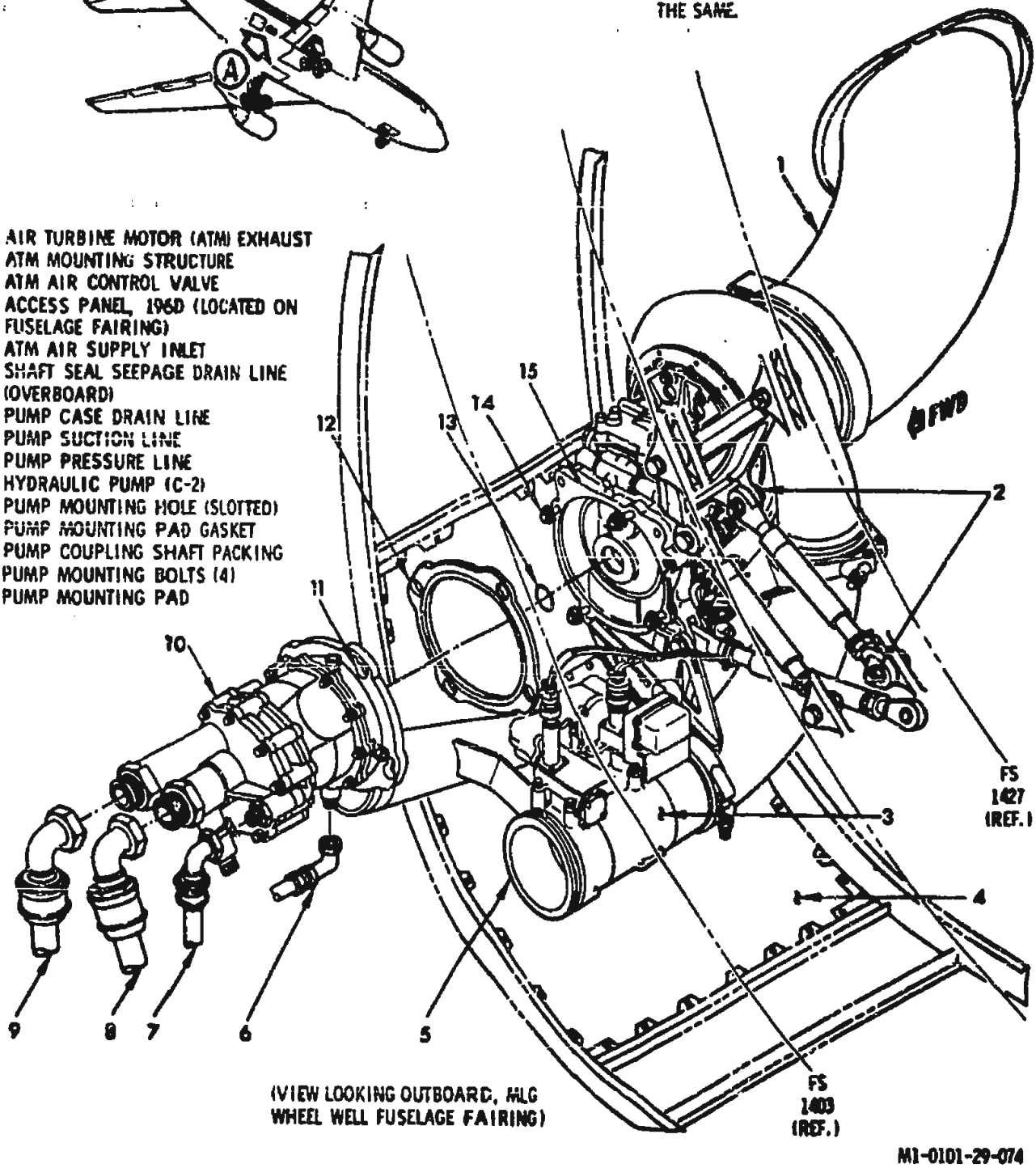
(d) Pump case is filled with hydraulic fluid

CAUTION: THE SUCTION LINE MUST BE FILLED WITH HYDRAULIC FLUID TO PREVENT CAVITATION OF PUMP DURING FIRST RUN.



NOTE
VIEW SHOWN IS FOR ATM DRIVEN HYDRAULIC PUMP C-2, REMOVAL AND INSTALLATION OF PUMP B-2, ZONE 195, IS ESSENTIALLY THE SAME.

1 AIR TURBINE MOTOR (ATM) EXHAUST
2 ATM MOUNTING STRUCTURE
3 ATM AIR CONTROL VALVE
4 ACCESS PANEL, 196D (LOCATED ON FUSELAGE FAIRING)
5 ATM AIR SUPPLY INLET
6 SHAFT SEAL SEEPAGE DRAIN LINE (OVERBOARD)
7 PUMP CASE DRAIN LINE
8 PUMP SUCTION LINE
9 PUMP PRESSURE LINE
10 HYDRAULIC PUMP (C-2)
11 PUMP MOUNTING HOLE (SLOTTED)
12 PUMP MOUNTING PAD GASKET
13 PUMP COUPLING SHAFT PACKING
14 PUMP MOUNTING BOLTS (4)
15 PUMP MOUNTING PAD



R Air Turbine Motor-driven Hydraulic Pump - Removal and Installation
R Figure 401

(2) Install pump port adapter fittings with new O-ring packings and lubricate with hydraulic fluid.

(3) With pump in horizontal mounting position, engage pump coupling shaft and gearbox drive coupling splines. Rotate as required to allow nuts to pass through pump mounting flange and install pump against mounting pad.

(4) Rotate pump counterclockwise until small ends of flange mounting slots are firmly against ATM gearbox studs.

(5) Tighten pump mounting nuts.

(6) Remove protective caps and plugs, and fill suction, pressure, and case drain lines with hydraulic fluid before connecting to pump adapter fittings.

(7) Connect shaft seal drain line to pump adapter.

(8) Remove tags and close circuit breakers opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on electrical power (Ref. 24-41-00).

(10) Open hydraulic service center access doors 147AB and 147BB.

(11) Pressurize and bleed applicable system as follows:

(a) Turn on applicable AC PUMP and ATM (Ref. 29-11-00).

(b) Operate flaps through 1 cycle (for Sys B ATM, also turn on B-A PTU).

(c) Check all connections for leakage.

(d) Perform applicable reservoir AIR BLEED and AIR CHECK in accordance with instructions on HYDRAULIC

SERVICE PANEL and RESERVOIR SERVICE INSTRUCTION placards, zone 147. Replenish applicable hydraulic reservoir if required (Ref. 12-13-01).

(12) Turn off AC PUMP and ATM (and B-A PTV, Sys B).

(13) Turn off electrical power (Ref. 24-41-00).

(14) Reinstall applicable access panel.

(15) Close and lock hydraulic service center access doors.

R AIR TURBINE MOTOR LUBE OIL COOLER - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

R 2. Referenced Procedures

R 12-12-61 Air Turbine Motor (ATM) - Servicing

R 29-11-39 Air Turbine Motor - Adjustment and Test

R 3. Removal/Installation

R A. Removal

R (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers ATM PUMP CONT & IND SYS B (L14), and ATM PUMP CONT & IND SYS C (L19).

R (2) On Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215, check that ATM switches for system B and system C are in OFF position. Tag switches.

R WARNING: TAG FLIGHT ENGINEER/SECOND OFFICERS BLEED AIR AND APU CONTROL PANELS AND THE THREE HIGH-PRESSURE GROUND AIR CONNECTIONS TO PREVENT OPERATION UNTIL COMPLETION OF PROCEDURES. RECENT OPERATION OF AIRCRAFT PNEUMATIC SYSTEM WILL REQUIRE PRECAUTIONS AGAINST DANGEROUSLY HIGH TEMPERATURES. PROTECTIVE GLOVES SHOULD BE USED WHEN REQUIRED.

R (3) Remove access panel 195D for system B ATM or panel 196D for system C ATM, as applicable.

R (4) On bottom of ATM gearbox near lube oil cooler, locate magnetic chip detector and self-closing valve (Ref. Fig. 401).

R (5) Cut lock-wire and remove magnetic chip detector. Inspect for chips (Ref. 29-11-39).

R (6) Provide suitable container to catch oil from ATM oil drain plug (approximately one quart).

R (7) Remove lock-wire, loosen self-closing valve and drain oil into container.

R (8) Use new packings (O-rings) and reinstall self-closing valve and torque 30 to 40 inch pounds. Install magnetic plug in self-closing valve and torque 15 to 20-inch pounds.

R (9) Cut lock-wire from oil cooler tube B-nuts and disconnect nuts from adapter fittings.

R (10) Remove attaching capscrews (7), hex head bolts (3) that secure the oil cooler to the air ejector and transition tube mounting bracket. Support cooler when last bolt is removed. Remove cooler from ATM.

R (11) Remove loop clamp and bracket from tube.

R B. Installation

R (1) Install loop clamp on tube of oil cooler and position oil cooler between air ejector and transition tube mounting bracket (Ref. Fig. 401).

R (2) Install three hex head bolts through air ejector flange, oil cooler flange and mounting bracket. Upper bolt also attaches loop clamp bracket to mounting bracket. Use washers under bolt heads and nuts.

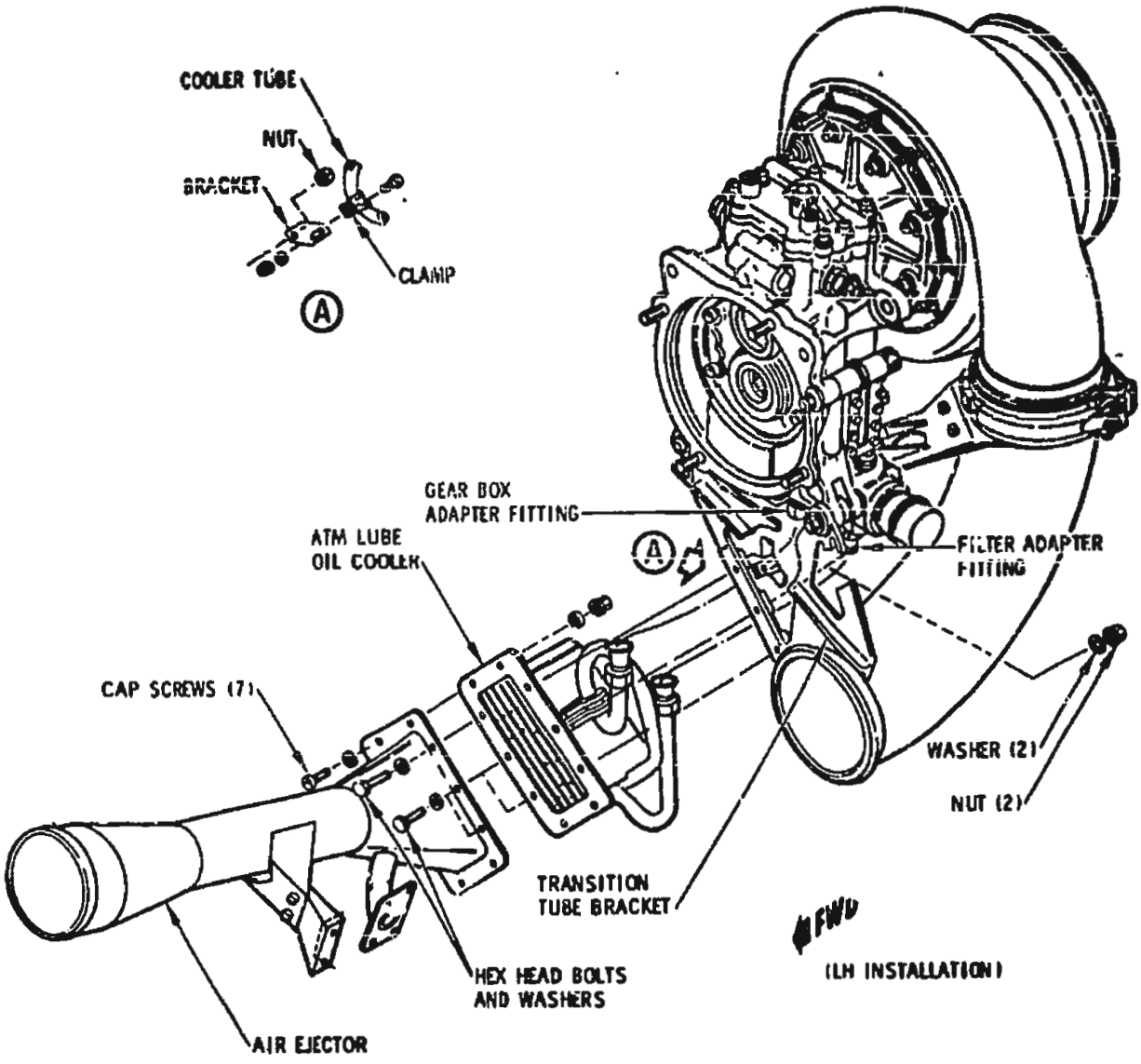
R (3) Connect oil cooler tube fittings to adapters on bottom of gearbox and filter housing. Torque fittings 75 to 125-inch pounds and lock-wire fittings.

R (4) Install capscrews through air ejector and oil cooler flanges. Use washers under capscrews and nuts.

R (5) Service ATM with lubricating oil (Ref. 12-12-61).

R (6) Perform ATM operational check (Ref. 29-11-39).

R (7) Recheck ATM lube oil level (Ref. 12-12-61).



NOTE
ATM SHOWN WITH HYDRAULIC PUMP AND AIR CONTROL VALVE REMOVED FOR CLARITY

M1-0100-29-323

R R ATM Lube Oil Cooler - Removal and Installation
Figure 401

R R 001B EFFECTIVITY: ALL

AIR TURBINE MOTOR EXHAUST DUCT - REMOVAL AND INSTALLATION

1. Referenced Procedure

20-36-01	Single T-bolt V-band Coupling - Removal and Installation
29-11-39	Air Turbine Motor (ATM) - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag applicable circuit breaker ATM PUMP CONT & IND SYS B (L13) or C (L19).

(2) Remove access panel (195D) for system B ATM or panel (196D) for system C ATM.

(3) Loosen V-band coupling and safety latch (Ref. 20-36-01) from ATM exhaust duct and ATM (Ref. Fig. 401).

(4) Remove screws and remove exhaust duct collar.

R (5) Remove bolt and flanged bushing securing exhaust duct to support rod.

(6) Remove exhaust duct.

B. Installation

(1) Verify that circuit breaker opened in Step A(1) is open.

(2) Insert exhaust duct through opening in panel and position as shown in Figure 401.

R (3) Center Exhaust Duct Exit Flange vertically, horizontally and longitudinally within the Exhaust Duct Fairing Collar. The Exhaust Duct Exit Flange must clear Exhaust Duct Fairing Collar by a minimum 0.18 inch vertically and 0.12 inch horizontally.

R (4) Install Exhaust Duct collar and secure with screws.

R (5) Orient duct in panel opening and secure in place by
R connecting support rod to duct with bolt, flanged
R bushing, washer, and nut.

R (6) Adjust ATM mounts to align ATM with Exhaust Duct Mount
R Flange.

R (7) Connect forward end of duct to ATM with V-band coupling
R (Ref. 20-36-01).

(8) Remove tag and close circuit breaker opened in Step A(1).

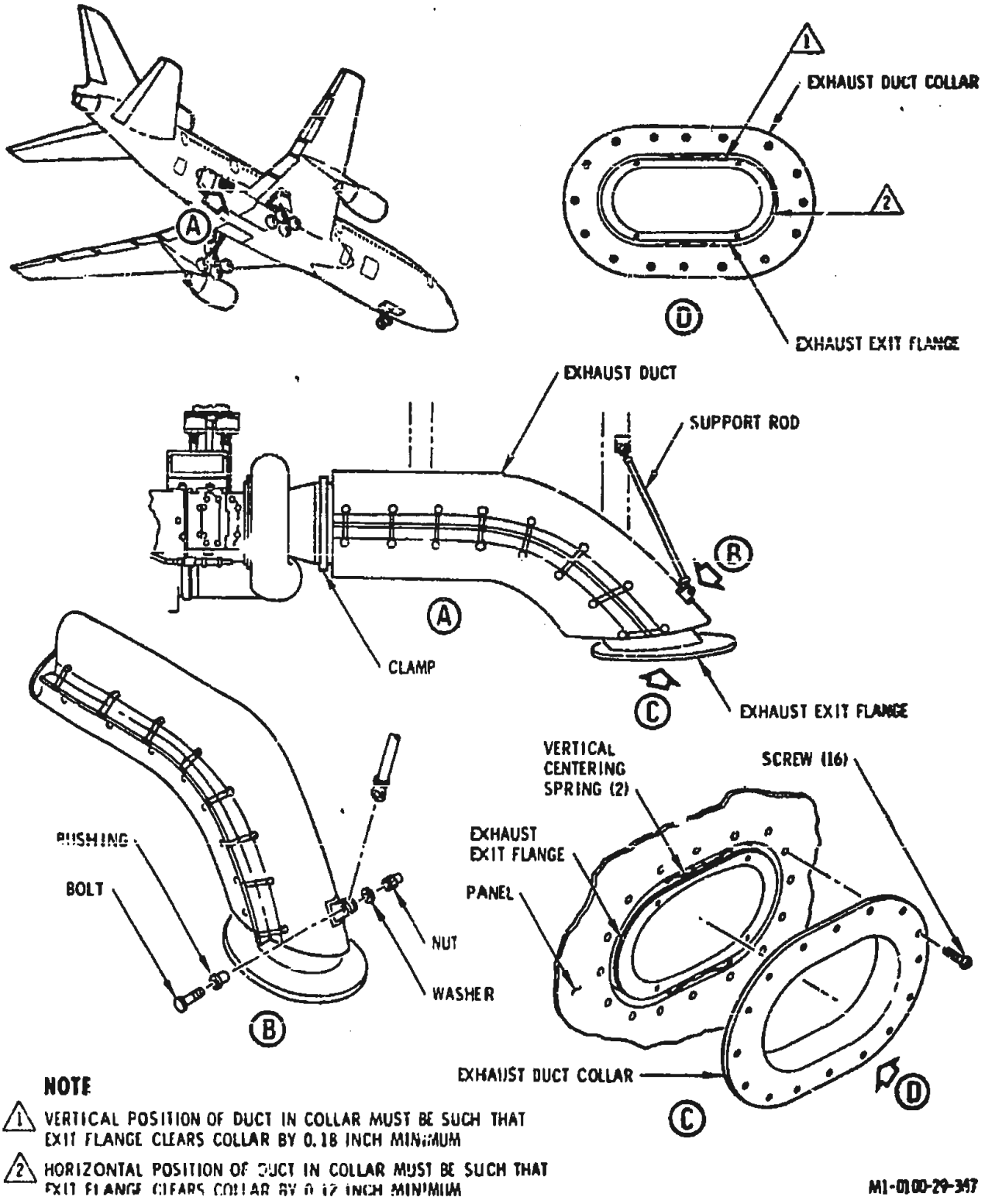
(9) Start up ATM (Ref. 29-11-39).

(10) Check exhaust duct connection at V-band coupling for leaks.

(11) Check junction of exhaust duct exit flange and collar for leaks.

(12) Turn off ATM (Ref. 29-11-39).

(13) Install access panel 195D or 196D as applicable.



NOTE

1. VERTICAL POSITION OF DUCT IN COLLAR MUST BE SUCH THAT EXIT FLANGE CLEARS COLLAR BY 0.18 INCH MINIMUM
2. HORIZONTAL POSITION OF DUCT IN COLLAR MUST BE SUCH THAT EXIT FLANGE CLEARS COLLAR BY 0.12 INCH MINIMUM

M1-0100-29-347

R R Air Turbine Motor Exhaust Duct - Removal and Installation
Figure 401

AIR TURBINE MOTOR EXHAUST DUCT - INSPECTION AND CHECK

1. General

The following procedure provides a visual inspection of the ATM exhaust duct interior for damage and hydrocarbon residues.

2. Equipment and Materials

Protective Gloves - Required if ATM has been recently operated

Inspection Mirror - Taped to a 4-foot extension handle (wood or tubing).

R The mirror must be able to fit through the ATM exhaust duct outlet screen (grid size approximately 1 X 2 inches.)

3. Inspection/Check

A. Procedure

(1) On Flight Engineer/Second Officers overheat circuit breaker panel CB2, Zone 215, open and tag circuit breakers ATM PUMP CONT & IND SYS B (L13) and ATM PUMP CONT & IND SYS C (L19).

(2) On Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, Zone 215, check that ATM switches for system B and system C are in OFF position. Tag switches.

CAUTION: TAG FLIGHT ENGINEER/SECOND OFFICERS BLEED AIR AND APU CONTROL PANELS AND THE THREE HIGH-PRESSURE GROUND AIR CONNECTIONS TO PREVENT OPERATION UNTIL COMPLETION OF PROCEDURES. RECENT OPERATION OF AIRCRAFT PNEUMATIC SYSTEM WILL REQUIRE PRECAUTIONS AGAINST DANGEROUSLY HIGH SYSTEM TEMPERATURES. PROTECTIVE GLOVES SHOULD BE USED WHEN REQUIRED.

R (3) Insert the mirror through the exhaust duct outlet collar (Ref. Fig. 601). The outlet screen has 1.0 inch by 2.0 inch openings.

(4) Check the interior of the duct for any damage, paying particular attention to the outboard surface just forward of the duct bend. Use a suitable light to ensure that no damage is overlooked.

Exhaust duct removal is required for any of the following reasons:

(a) Holes or breaks in the open weave inner liner.

CR (b) More than two missing or broken adjacent static
CR ground wires.

CR (c) More than two missing or broken alternate static
CR ground wires.

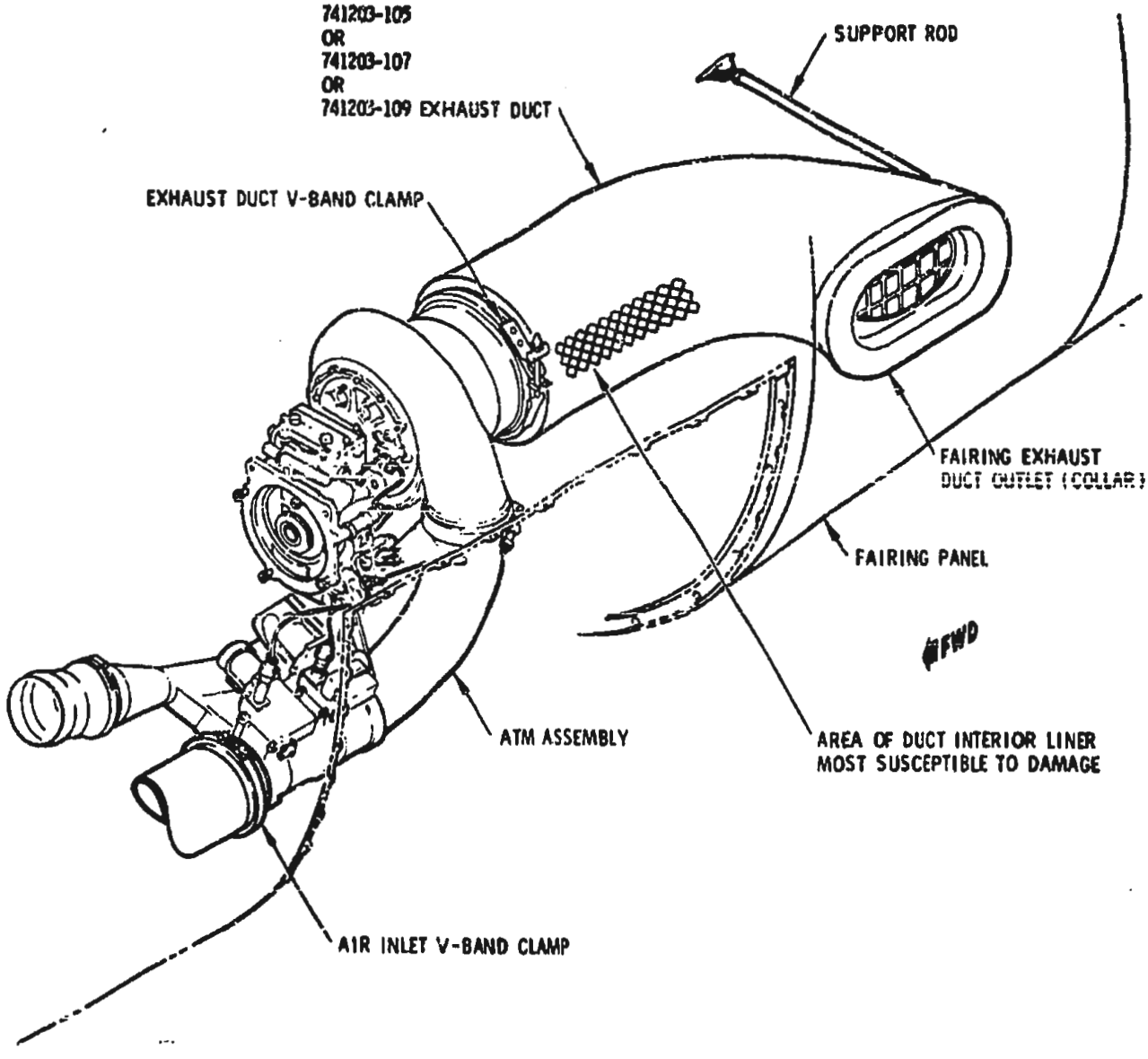
CR (d) Excessive oil accumulation

CR NOTE: 1) Duct may be removed, cleaned and
CR reinstalled. Insure oil drain tubes are
CR open.

CR 2) Check ATM for excessive oil (Shaft
CR Seal) leakage. Replace the ATM as
CR required.

CR (5) The duct may be replaced without removing the ATM assembly by removing the exhaust duct outlet fairing collar, the V-band clamp at the ATM end of the duct, and disconnecting the support rod at the aft inboard end of the duct. The damaged duct can be removed and the replacement duct installed through the outlet hole in the fairing panel.

CR (6) Remove tags and close circuit breakers opened in Step (1), and remove tags from HYDRAULIC SYSTEM control panel switches.



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ATM Exhaust Duct Inspection
Figure 601

MOTOR-OPERATED RUDDER HYDRAULIC FUSING SHUTOFF VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3-gallon)

Protective plugs and caps

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Hydraulic Service cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

Control column and trim wheel lock, PN BA80, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-11-74	Motor-Operated Rudder Hydraulic Fusing Shutoff Valve - Adjustment and Test

3. Removal/Installation

R A. Removal (Ref. Fig. 401)

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker RUDDER FUSING SYS (L16).

(2) Open hydraulic service center access doors 147AB and 147BB.

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147. INSTALL CONTROL COLUMN AND TRIM WHEEL LOCK.

CAUTION: USE CAUTION TO PREVENT DAMAGE TO HYDRAULIC LINES AND COMPONENTS WHEN ENTERING AFTERBODY AREA, ZONE 317, THROUGH ACCESS DOOR 317BB.

(3) Gain access to the afterbody area.

NOTE: The shutoff valve is located on the forward side of FS 1975 in aft fuselage area above horizontal stabilizer (left side between S-duct and fuselage outer panel).

(4) Disconnect electrical connector from hydraulic fusing shutoff valve (Ref. Fig. 401).

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING
R ANY HYDRAULIC LINES. VERIFY ZERO PSI AT
R RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE
R PANEL (REF. 29-11-00, 201).

(5) Position fluid container to catch fluid drainage, and disconnect hydraulic lines from valve.

(6) Remove mounting bolts and remove valve.

(7) Place protective caps and plugs on all open fittings and ports.

B. Installation (Ref. Fig. 401)

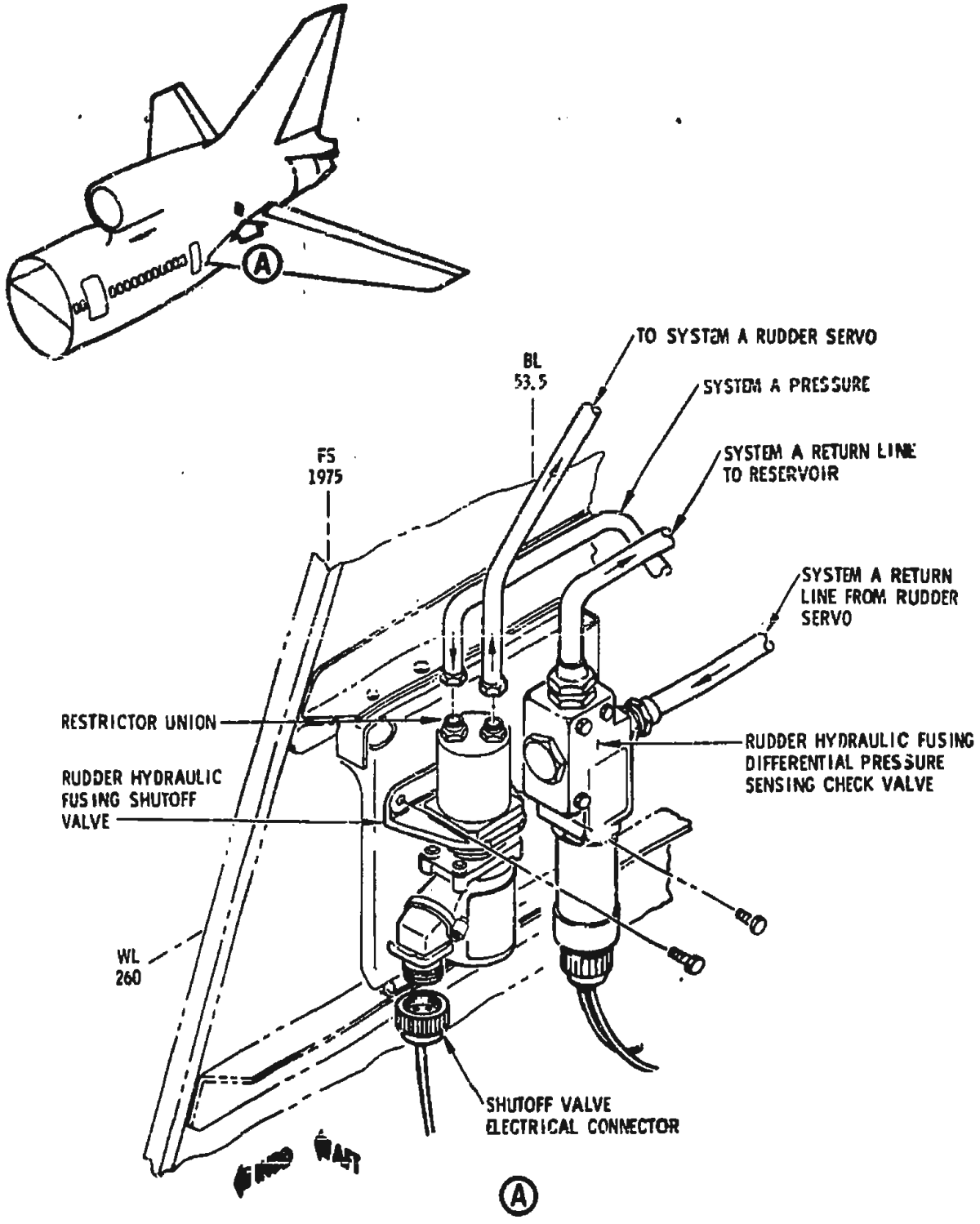
(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged, hydraulic controls are tagged in OFF position, and the control column and trim wheel lock is installed.

(2) Place shutoff valve in position and install mounting bolts.

(3) Remove protective plugs and caps from fittings and ports.

(4) Connect hydraulic lines to shutoff valve.

CAUTION: VERIFY THAT HYDRAULIC LINES ARE NOT CROSSED OR SHUTOFF VALVE WILL NOT SHUT OFF PRESSURE. THE VALVE IS MARKED "IN" AND "OUT" AND BOTH LINES ARE DECALED WITH FLOW ARROWS. THE INPUT LINE COMES UP FROM BELOW AND SHOULD BE CONNECTED TO THE "IN" PORT. THE OUTPUT LINE EXTEND UPWARD TOWARDS THE RUDDER SERVO AND SHOULD BE CONNECTED TO THE "OUT" PORT.



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R Motor-Operated Rudder Hydraulic Fusing Shutoff Valve
R Removal and Installation
R Figure 401

(5) Connect electrical connector to shutoff valve receptacle.

(6) Remove tag and close circuit breaker opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Remove control column and trim wheel lock.

(8) Turn on electrical power (Ref. 24-41-00).

(9) Pressurize and bleed system A as follows:

(a) Turn on B3 AC MOTOR PUMP and B-A PTU.

(b) Slowly operate rudder through 10 complete cycles.

(c) Slowly operate stabilizer through 5 complete cycles.

(d) Check rudder hydraulic fusing shutoff valve and hydraulic fittings for leakage.

(e) Perform system A reservoir AIR BLEED and AIR CHECK in accordance with instructions on RESERVOIR SERVICE INSTRUCTIONS placard; replenish fluid if required (Ref. 12-13-01).

(10) Test operation of rudder hydraulic fusing shutoff valve (Ref. 29-11-74, Adjustment and Test).

(11) Turn off electrical power if no longer required (Ref. 24-41-00).

(12) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(13) Close and lock hydraulic service center access doors.

(14) Close access door 317BB.

MOTOR-OPERATED RUDDER HYDRAULIC FUSING SHUTOFF VALVE ADJUSTMENT AND TEST

1. General

R Paragraph 3 provides an operational test of the system A rudder hydraulic fusing system. Both the motor-operated shutoff valve and the differential pressure sensing check valve are tested.

Paragraph 4 provides an alternate reset procedure for the rudder hydraulic fusing system.

2. Referenced Procedures

R

24-00-00	Electrical Power - Maintenance Practices
27-21-00	Rudder Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-00	Ram Air Turbine System - Maintenance Practices

R 3. Operational Test

R The following procedure provides an operational test of the
R system A hydraulic fusing (rudder fusing) with all indicators
R functioning in normal manner; and an operational test to
R determine if the fusing system is fully operational with the
R SYSTEM A HYDRAULIC FUSING light on.

R NOTE: The differential pressure sensing check valve contains a
R solid state relay and time delay. The switching
R circuitry consists of two circuits; one turns on the
R SYSTEM A HYDRAULIC FUSING indicator light and the other
R directs power to operate the motor-operated shutoff
R valve.

R It is possible for the indicator light circuit to fail
R and in failing, turn on the indicator light but not
R affect the circuit to the shutoff valve.

R The following procedure will determine if the fusing
R system is operational.

R A. Preparation

R (1) On Flight Engineer/Second Officers circuit breaker
R panel, CB2, verify the following circuit breakers are
R closed:

R RUDDER SERVO A (K12)

R RUDDER SERVO B (K13)

R AC PUMP B3 (L12) or ATM PUMP CONT & IND SYS B (L13) (AS
R APPLICABLE)

R PTU CONT & IND SYS B-A (L14)

R RUDDER FUSING SYS (L16)

R (2) On pilots overhead circuit breaker panel CB1, open the
following circuit breaker:

RAT AUTO DEPLOY (L3)

R (3) On Flight Engineer/Second Officers circuit breaker
R panel CB2, open the following circuit breaker:

MLG GND SENSE (L8)

R (4) Turn on electrical power (24-00-00).

(5) On pilots overhead PFCS panel, verify RUDDER (under guard) switchlight is latched in (INOP light off).

(6) Open hydraulic service center, 147AB door and establish communications between flight station and hydraulic service center.

(7) Install RAT ground safety lock (Ref. 29-21-00).

R R (8) Connect a hydraulic reservoir serviceing cart to System A reservior servicing connections.

B. Test

(1) In Hydraulic Service Center, on SYSTEM A HYDRAULIC FUSING test panel, press and release PRESS TO TEST light to verify operation of lamp and to verify power is being supplied to the fuse circuit.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic system B. Verify other hydraulic systems are off (Ref. 29-11-00).

(3) On the Hydraulic Service Panel, in the Hydraulic Service Center, turn on PTU B-A. Verify and maintain 2400 PSI minimum system A pressure and 64 PSI minimum system A reservoir pressure.

(4) On the Hydraulic Service Panel, in the Hydraulic Service Center, turn off PTU B-A. Verify the system A reservoir accumulator pressure gage maintains a minimum of 1600 psi.

(5) In the Hydraulic Service Center, on system A reservoir, move handle to the depressurize reservoir position for five or more seconds, verify system A reservoir pressure gage reads zero, then return handle to its
R normal position. With hydraulic reservoir servicing

R cart, start adding hydraulic fluid to reservoir as
R handle is released. Continue adding fluid for up to
R five seconds untill PRESS TO TEST light comes on.

R NOTE: Servicing cart must be capable of delevering 65
R psi minimum pressure. The purpose of the
R servicing cart is to pressurize the return
R system which will cause the differential
R pressure sensing check valve to close. Some
R fluid will be added to the hydraulic system.

(6) Verify after approximately 3 seconds, Rudder Fusing Test panel PRESS TO TEST light comes on. If light does not come on, a faulty differential pressure sensing check valve should be suspected.

(7) On Flight Engineer/Second Officers circuit breaker panel CB2, open RUDDER SERVO A (K12).

(8) On pilots overhead PFCS panel, lift guard and unlatch RUDDER switchlight (light comes on).

(9) On Flight Engineer/Second Officers Hydraulic System panel, turn on PTU B-A.

(10) Operate rudder pedals to verify fuse is closed. No rudder deflection should be observed.

(11) On Flight Engineer/Second Officers Hydraulic System panel, turn off PTU B-A.

(12) In Hydraulic Service Center, on system A reservoir, move handle to the depressurize position and hold. Verify Rudder Fusing Test panel PRESS TO TEST light goes off.

(13) On Flight Engineer/Second Officers circuit breaker panel CB2, close MLG GND SENSE (L8).

(14) Release system A reservoir depressurization valve.

(15) On Flight Engineer/Second Officers Hydraulic System panel, turn on PTU B-A.

(16) Operate rudder pedals to verify fuse is open. Rudder deflection should be observed.

NOTE: Rudder fuse is now open and operational test is completed.

C. Aircraft Securing

(1) Turn off hydraulic system B and PTU B-A (Ref. 29-11-00).

(2) On Flight Engineer/Second Officers circuit breaker panel CB2, close RUDDER SERVO A (K12).

(3) On pilots overhead PFCS panel, latch RUDDER switchlight (light goes off).

(4) On pilots overhead circuit breaker panel CB1, close RAT AUTO DEPLOY (L3).

R (5) Verify fluid level is acceptable in hydraulic system A
R reservoir, service as necessary and disconnect
R hydraulic reservoir service cart.

R (6) Turn off electrical power (Ref. 24-00-00).

R (7) Remove RAT ground safety lock (Ref. 29-21-00).

R (8) Close hydraulic service center 147AB door.

4. Fusing System Alternate Reset

A. This procedure permits a reset of the rudder hydraulic fusing system without using hydraulic service center controls and indicators.

(1) On Flight Engineer/Second Officers breaker panel, CB2, verify following circuit breakers are closed:

RUDDER SERVO B (K13)

AC PUMP B3 (L12) or ATM PUMP CONT & IND SYS B (L13) (AS APPLICABLE)

PTU CONT & IND SYS B-A (L14)

RUDDER FUSING SYS (L16)

(2) On pilots overhead circuit breaker panel CB1, open the following circuit breaker:

RAT AUTO DEPLOY (L3)

(3) On Flight Engineer/Second Officers circuit breaker panel CB2, open the following circuit breakers:

RUDDER SERVO A (K12)

MLG GND SENSE (L8)

(4) Turn on electrical power (Ref. 24-00-00).

(5) On pilots overhead PFCS panel, lift guard and unlatch RUDDER switchlight (light comes on).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on hydraulic system B and PTU B-A (Ref. 29-11-00). Verify other hydraulic systems are off.

(7) On Flight Engineers/Second Officers overhead circuit breaker panel CB2, open, then immediately close RUDDER FUSING SYS (L16) circuit breaker.

(8) Repeat Step (7) for 3 to 5 cycles at 4 second intervals.

(9) In forward electronic service center, on center rack, verify that flight control auxiliary unit panel RUDDER HYDRAULIC LIMITER A indicator light is off.

(10) Operate rudder pedals to verify fuse is open. Rudder deflection should be observed.

NOTE: If RUDDER HYDRAULIC LIMITER A indicator light is off and rudder moves, fusing system has been reset.

(11) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, close the following circuit breakers:

RUDDER SERVO A (K12)

MLG GND SENSE (L8)

(12) On pilots overhead circuit breaker panel CB1, close the following circuit breaker:

RAT AUTO DEPLOY (L3)

(13) Turn off hydraulic system B and PTU B-A (Ref. 29-11-00).

(14) Turn off electrical power (Ref. 24-00-00).

HYDRAULIC FUSING DIFFERENTIAL PRESSURE SENSING CHECK VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid container (3-gallon)

Protective plugs and caps

Hydraulic Fluid, LAC Spec C34-1224, or equivalent

Hydraulic Service cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

Control column and trim wheel lock, PN BA80, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-11-74	Motor-operated Rudder Hydraulic Fusing Shutoff Valve - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker RUDDER FUSING SYS (L16).

(2) Open hydraulic service center access doors 147AB and 147BB.

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT
R OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
R HYDRAULIC SERVICE PANEL, ZONE 147. INSTALL
R CONTROL COLUMN AND TRIM WHEEL LOCK.

R CAUTION: USE CAUTION TO PREVENT DAMAGE TO HYDRAULIC LINES
R AND COMPONENTS WHEN ENTERING ZONE 317 THROUGH
R ACCESS DOOR 317BB.

(3) Gain access to zone 317.

NOTE: The differential pressure sensing check valve is located on the forward side of FS 1975 in aft fuselage area above horizontal stabilizer (left side between S-duct and fuselage outer panel).

(4) Disconnect electrical connector from differential pressure sensing check valve (Ref. Fig. 401).

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
R HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR
R PRESSURE GAGE ON HYDRUALIC SERVICE PANEL (REF.
R 29-11-00,201).

(5) Position fluid container to catch fluid drainage, and disconnect hydraulic lines from valve.

(6) Remove mounting bolts and remove valve.

(7) Place protective caps and plugs on all open fittings and ports.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged, and that hydraulic controls are tagged in OFF position.

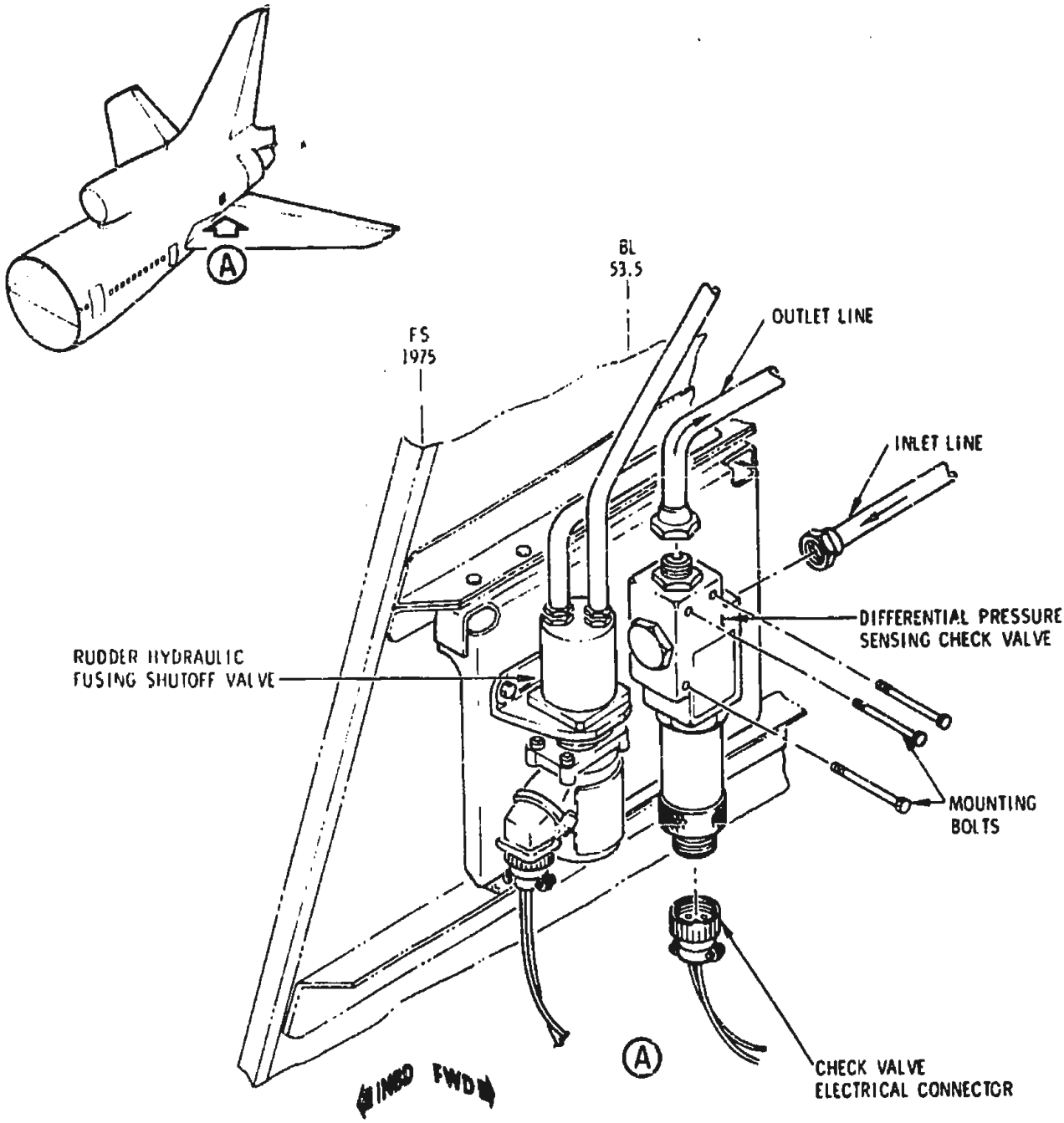
(2) Place check valve in position and install mounting bolts.

(3) Remove protective plugs and caps from fittings and ports.

(4) Connect hydraulic lines to check valve.

(5) Connect electrical connector to check valve receptacle.

(6) Remove tag and close circuit breaker opened in Step 3A(1).



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R Hydraulic Fusing Differential Pressure Sensing Check Valve
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

R R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Remove control column and trim wheel lock.

(8) Turn on electrical power (Ref. 24-41-00).

(9) Pressurize and bleed system A as follows:

(a) Turn on B3 AC MOTOR PUMP and B-A PTU.

(b) Operate rudder through 5 complete cycles.

(c) Operate stabilizer through 5 complete cycles.

(d) Check rudder hydraulic fusing differential pressure sensing check valve and hydraulic fittings for leakage.

(e) Perform system A reservoir AIR BLEED and AIR CHECK in accordance with instructions on RESERVOIR SERVICE INSTRUCTIONS placard. Check fluid level and replenish if required (Ref. 12-13-01).

(10) Test operation of rudder hydraulic fusing differential pressure sensing check valve (Ref. 29-11-74).

(11) Turn off electrical power (Ref. 24-41-00).

(12) Close and lock hydraulic service center access door.

(13) Close access door 317BB.

ATM AUTO CONTROL HYDRAULIC PRESSURE SWITCH REMOVAL AND INSTALLATION

1. Equipment and Materials

   O-ring, NAS1612-6, or equivalent

   Lock-wire, Fed Spec QQ-W-390, 0.020-inch diameter, or equivalent

   Container, one quart capacity, or equivalent

   Protective plug to fit switch boss

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
29-11-00	Hydraulic Power System - Maintenance Practices
29-11-39	Air Turbine Motor - Adjustment and Test

3. Removal/Installation

   A. Removal

      (1) Turn off applicable hydraulic system B or C pressure and depressurize reservoir system to reduce hydraulic pressure to 0 psi.

      (2) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag applicable circuit breaker ATM PUMP CONT & IND SYS B or SYS C (L13 or L19).

      (3) On Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215, verify that ATM switch for applicable system B or C is in OFF position. Tag switch.

      (4) Remove access panel 195D for system B or panel 196D for system C panel as applicable (Ref. 6-40-00).

      (5) Disconnect electrical connector from switch (Ref. Fig. 401).

R R R WARNING: DEPRESSURE ACCUMULATORS BEFORE LOOSENING ANY LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

(6) Position container to catch spilling hydraulic fluid and remove switch.

(7) Install plug in switch boss to prevent contamination.

B. Installation

(1) Verify that applicable hydraulic system B or C pressure is 0 psi.

(2) Verify that circuit breaker opened in Step A(2) is open and tagged.

(3) Verify that switch called out in Step A(3) is in OFF position.

(4) Install new O-ring packing on pressure switch.

(5) Position container under switch boss and remove plug.

(6) Install switch. Tighten switch to a torque of 45 to 60 lb in., keeping wrench as near 90 degrees to switch body as possible in order to minimize bending loads (Ref. Fig. 401).

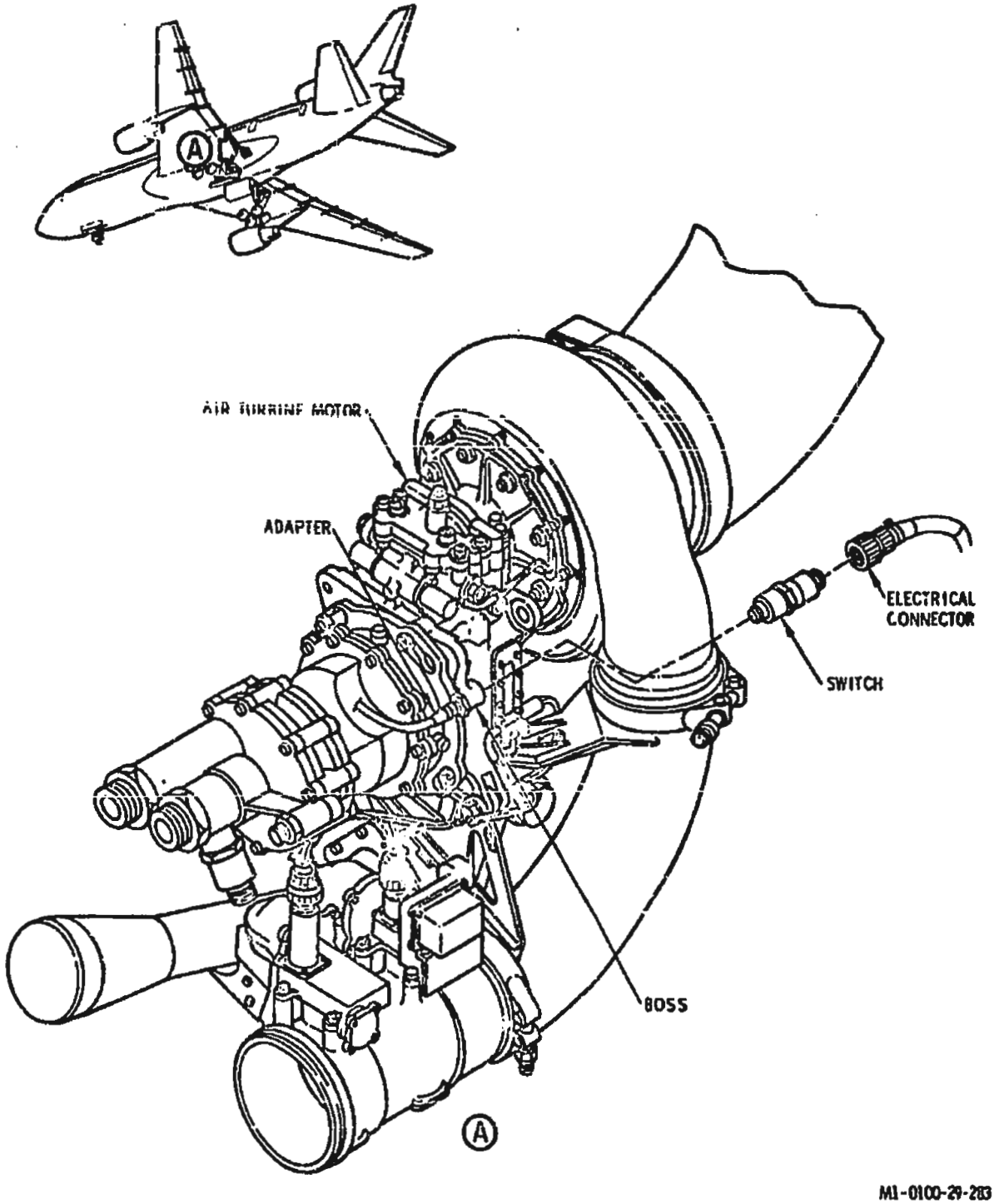
(7) Safety switch to boss adapter with lock-wire.

(8) Install electrical connector on switch.

(9) Safety connector to switch with lock-wire.

(10) Perform air turbine motor adjustment and test (Ref. 29-11-39).

(11) Install access panel.



M1-0100-29-283

R Air Turbine Motor Auto Control Pressure Switch
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL

R
R
001B

ELECTRIC MOTOR-DRIVEN HYDRAULIC PUMP RIPPLE DAMPER REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid Container

Protective plugs

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Packing (O-ring) NAS 1612-8, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, open and tag circuit breaker HYDRAULIC AC PUMP B3 (L12), or C3 (L22) as applicable.

(2) Open service center access doors 147AB and 147BB (Ref. Fig. 401).

NOTE: The ripple dampers are mounted on the left and right sidewalls near the aft bulkhead of the hydraulic service center. Removal and installation procedures are identical for the B3 or C3 pump ripple dampers.

CAUTION: USE EXTREME CARE TO PREVENT DAMAGE TO HOSES FROM BENDING OR KINKING DURING RIPPLE DAMPER REMOVAL.

(3) Verify that the applicable hydraulic system pressure and reservoir pressure is zero psi (29-11-00, 201).

(4) Position fluid container to catch fluid drainage.

R R R R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

(5) Loosen and disconnect hydraulic connector from AC pump pressure hose to ripple damper and catch fluid. Plug hose fitting to stop fluid drainage.

(6) Loosen both hydraulic fittings of hydraulic tube connected to ripple damper upper fitting. Disconnect from ripple damper and rotate tube away to provide clearance.

(7) Plug tube connector fitting to stop fluid drainage and temporarily tighten connector at check valve fitting.

(8) Remove ripple damper mounting clamp bolts, noting clamp position and retain clamp and bolts for reinstallation. Remove ripple damper from aircraft.

(9) Remove adapter fittings from ripple damper, discard O-ring packings, retain adapters for reinstallation.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

(2) Install adapter fittings with new O-ring packings lubricated with clean hydraulic fluid in ripple damper.

(3) Position ripple damper in place and install mounting clamps and attaching bolts, do not tighten bolts.

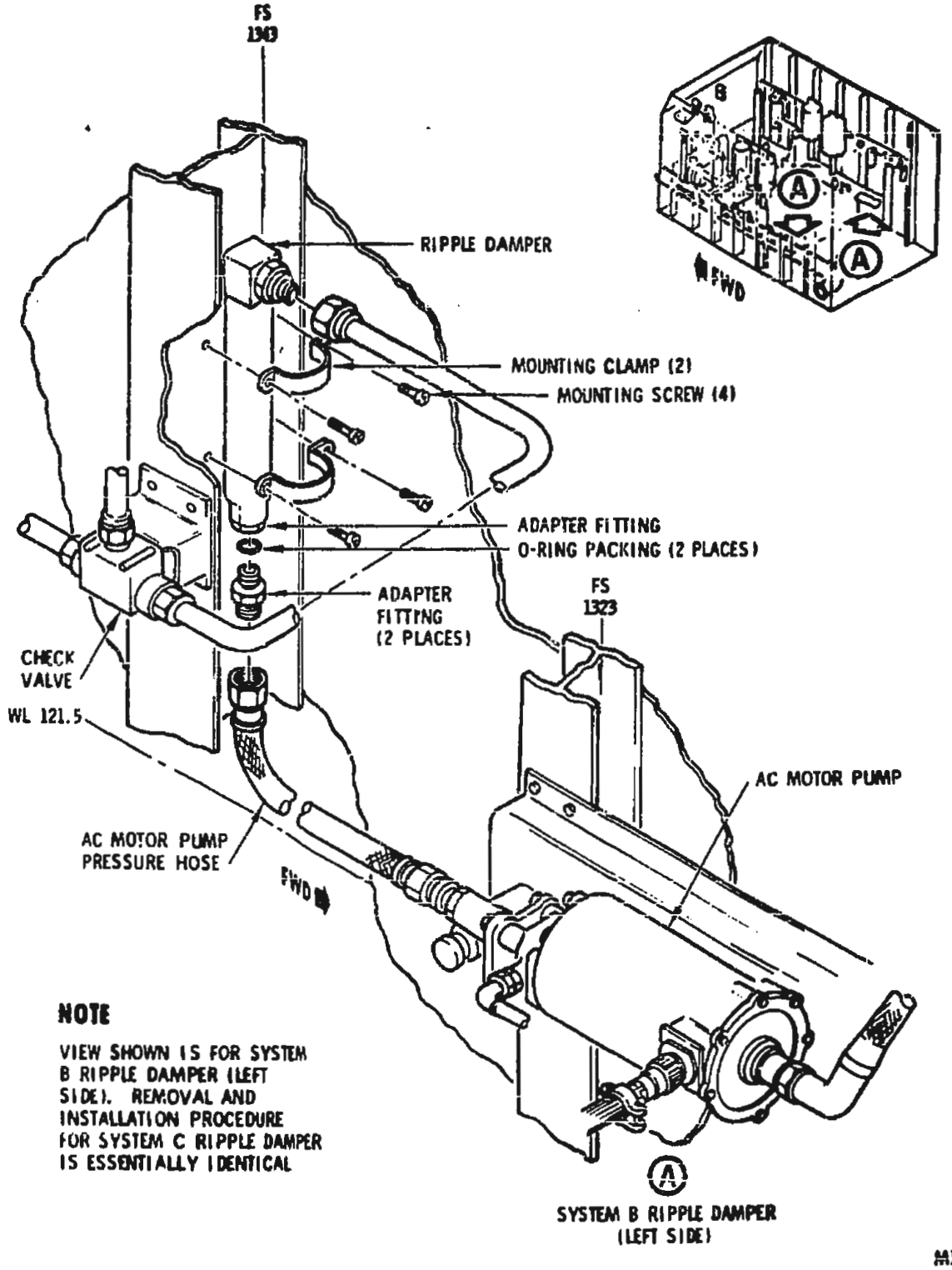
(4) Loosen hydraulic connector of tube at check valve fitting, remove connector plug and rotate tube into position and connect to upper fitting of ripple damper.

(5) Remove plug from ac pump pressure hose and connect to ripple damper lower end fitting, do not tighten fitting.

(6) Tighten upper tube connectors and then tighten ripple damper mounting clamp bolts.

CAUTION: USE EXTREME CARE TO PREVENT BENDING, KINKING OR INTRODUCING A TWISTING PRELOAD IN THE HOSE WHEN TIGHTENING FITTINGS.

(7) Tighten ac pump pressure hose fitting at ripple damper lower fitting.



M1-0100-29-350

R Electric Motor-driven Hydraulic Pump Ripple Damper
R Removal and Installation
R Figure 401

(8) Remove tag and close circuit breaker opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on electrical power (Ref. 24-41-00).

(10) Replenish hydraulic fluid level in reservoir (Ref. 12-13-01).

(11) Pressurize and bleed applicable system as follows:

(a) On pilots overhead PFCS panel, position all servos except system A to OFF.

(b) Turn on B3 AC MOTOR PUMP and B-A PTU.

(c) Turn on C3 AC MOTOR PUMP.

(d) Operate flaps through one cycle.

(12) Check fittings for evidence of leakage.

(13) Perform reservoir AIR BLEED, AIR CHECK and FLUID QUANTITY CHECK in accordance with RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 12-13-01).

(14) Turn off electrical power (Ref. 24-41-00).

(15) Close and lock hydraulic service center access doors.

ATM-DRIVEN HYDRAULIC PUMP RIPPLE DAMPER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid Container

Protective Plugs

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Packing (O-ring) NAS 1612-12, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System-Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit
R breakers ATM PUMP CONT & IND SYSTEM B or C (L13) or
R (L19), as applicable, and AC PUMP B3 or C3 (L12) or
R (L22), as applicable.

(2) Verify that the applicable B or C hydraulic system pressure and reservoir pressure is zero psi (29-11-00).

(3) Remove access panel 195D for system B (LH MLG FUS fairing) or 196D for system C (RH MLG FUS fairing) as applicable (Ref. Fig. 401).

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING
R ANY LINES OR COMPONENTS. VERIFY ZERO PSI ON
R HYDRAULIC PRESSURE GAGE ON HYDRAULIC SERVICE
R PANEL.

(4) Position fluid container to catch fluid drainage from hydraulic pressure hose. Disconnect hydraulic pressure hose fittings from ripple damper and install protective plugs to minimize fluid drainage.

(5) Remove ripple damper bracket/clamp mounting screws, noting positions for reinstallation and remove ripple damper from aircraft.

(6) Remove adapters from ripple damper noting position of adapters and mounting brackets, discard O-ring packing, retain adapters for reinstallation.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Install adapter fittings with new O-ring packings lubricated with clean hydraulic fluid.

(3) Place ripple damper in position on mounting bracket with end brackets and clamps in position to eliminate end movement of damper. Tighten clamp screws.

CAUTION: USE EXTREME CARE TO PREVENT BENDING, KINKING OR INTRODUCING A TWISTING PRELOAD IN THE HOSE WHEN TIGHTENING FITTINGS.

(4) Remove protective plugs from hose fittings and connect hoses to ripple damper adapter fittings and tighten.

(5) Remove tags and close circuit breakers opened in Step 3A(1).

(6) Turn on electrical power (24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

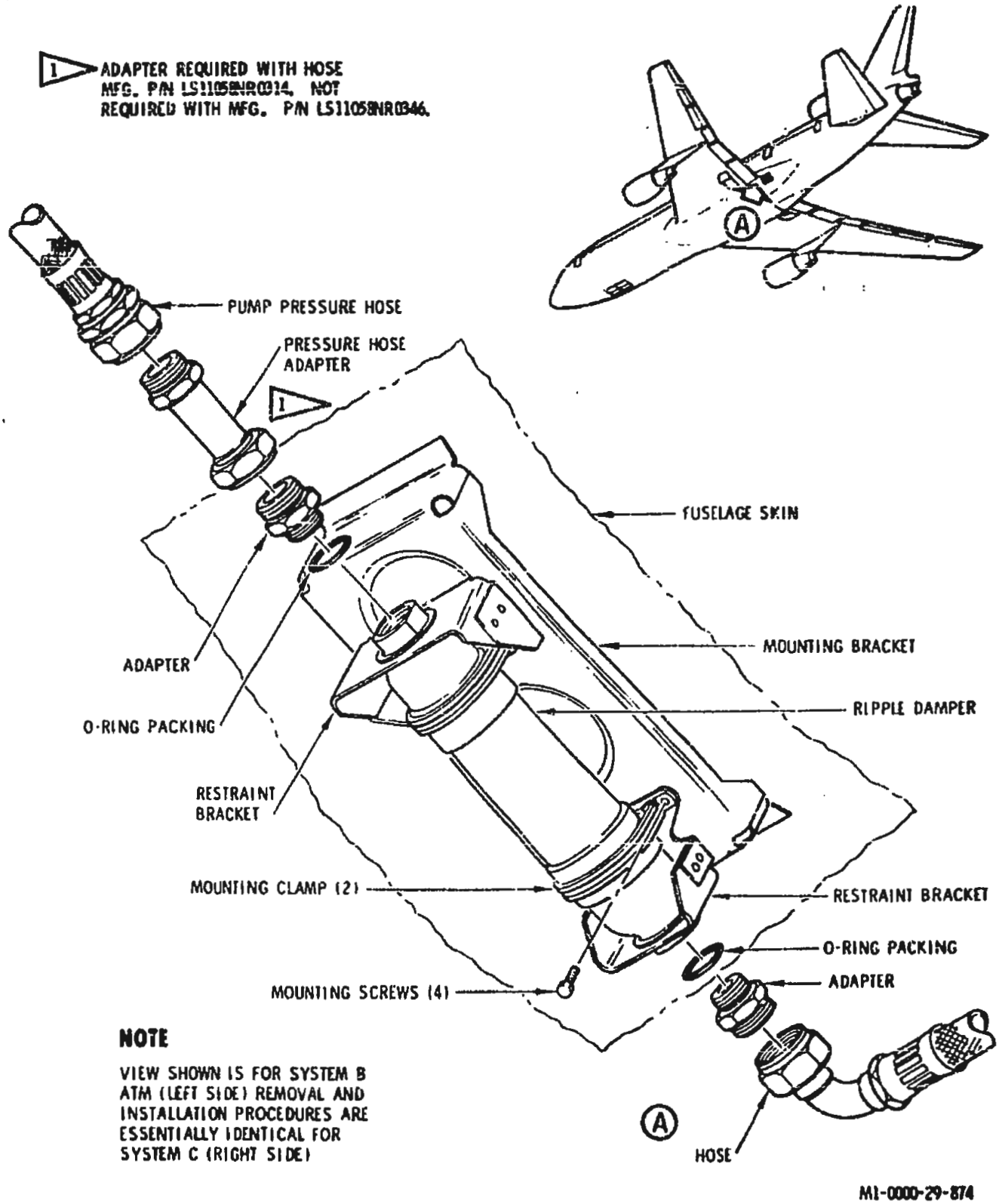
LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

THE ATM EXHAUST AREA IS CLEAR OF PERSONNEL AND EQUIPMENT.

(7) Perform air bleed of ATM-driven pump ripple damper and pressure line as follows:



CR ATM-driven Hydraulic Pump Ripple Damper - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL

001B

(a) On the pilots overhead panel, position the PFCS panel RUDDER, STABILIZER AILERON, and SPOILER switchlights (released out) to OFF or INOP.

NOTE: Flight control servos are shut off to prevent air movement into flight control system.

(b) Operate the applicable ATM (Ref. 29-11-00, 201). During ATM operation operate controls applicable to system affected as follows:

System B, operate B-A PTU and flaps (1 cycle)

System C, operate flaps (1 cycle)

(c) Turn off ATM and reposition flight control servo switches on PFCS panel to original position.

(8) Check all hydraulic connections at ripple damper for evidence of leakage.

(9) Perform reservoir AIR CHECK and reservoir AIR BLEED in accordance with instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placards, zone 147.

(10) Turn off electrical power (24-41-00).

(11) Install access panel, 195D or 196D as applicable.

(12) Close and lock hydraulic service center doors.

RESERVOIR DEPRESSURIZATION VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224 or equivalent

Fluid Container, (5-gallon for systems A, B, and D; 10-gallon for system C)

Packing Seal (O-ring) NAS 1612-6

Packing Seal (O-ring) LS10115-017, -018

Cap ring (backup ring) LS35056-018, -019

Lockwire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Bootstrap Reservoir - Servicing
29-00-00	Hydraulic Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: VERIFY THAT THE RAM AIR TURBINE (RAT) SAFETY LOCK IS INSTALLED OVER RAT DOORS.

CAUTION: OBSERVE WARNING AND CAUTION INSTRUCTIONS FOR HYDRAULIC FLUID HANDLING (Ref. 29-00-00).

(1) Open hydraulic service center access doors 147AB and 147BB.

(2) Verify that the applicable hydraulic system is shut off (Ref. 29-11-00); tag Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and HYDRAULIC SERVICE PANEL, zone 147, to prevent pressurization of system during valve removal.

(3) Verify that the applicable hydraulic reservoir is depressurized. Actuate valve at base of reservoir

R until SYS RESERVOIR PRESSURE gage on HYDRAULIC SERVICE PANEL indicates zero psig).

R (4) Place fluid container under applicable reservoir drain port; remove drain plug and drain fluid.

(5) Replace drain plug and lock-wire.

(6) Disconnect hydraulic connector from depressurization valve (Ref. Fig. 401).

(7) Remove adapter from valve and discard O-ring packing.

(8) Remove mounting screws from depressurization valve and remove valve from reservoir. Discard O-ring packings.

B. Installation

(1) Verify that reservoir depressurization valve and cavity are clean.

(2) Lubricate valve O-ring packings and cap rings with hydraulic fluid. Verify that cap rings are in proper position (Ref. Fig. 401).

(3) Install valve in reservoir cavity; install mounting screws with washers under head and tighten.

(4) Lubricate adapter fitting O-ring with hydraulic fluid, position on adapter, install in valve port and tighten.

(5) Connect reservoir pressurization line connector to valve adapter and tighten.

(6) Lock-wire mounting screws.

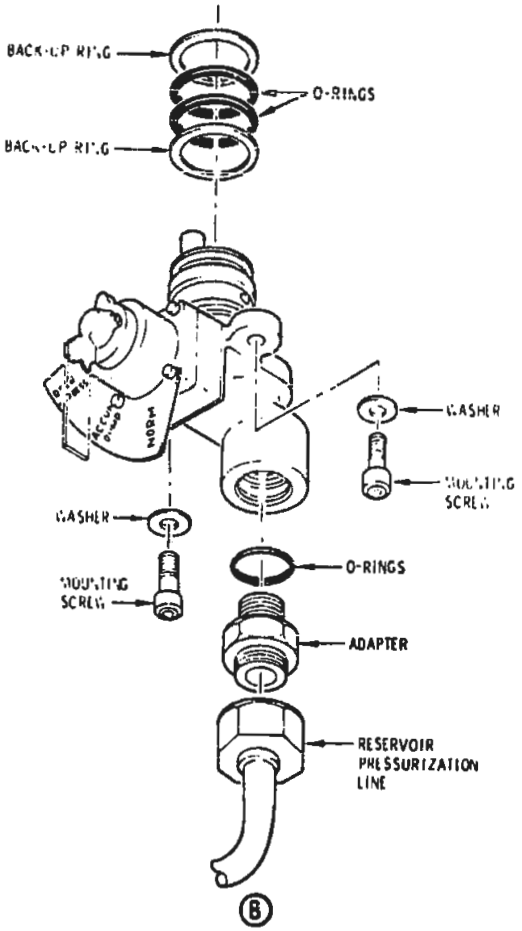
(7) Fill reservoir with hydraulic fluid (Ref. 12-13-01).

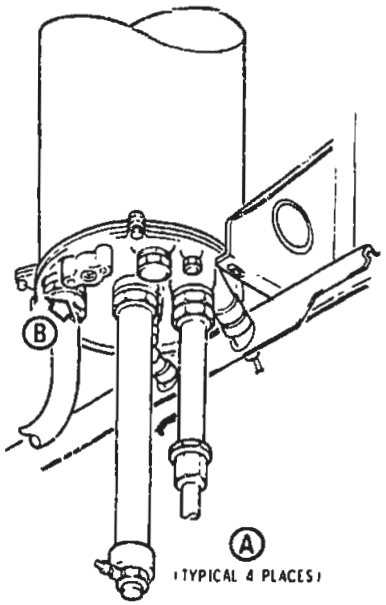
(8) Pressurize applicable system (Ref. 29-11-00) and perform reservoir AIR BLEED and AIR CHECK in accordance with instructions on RESERVOIR SERVICING INSTRUCTIONS placard and HYDRAULIC SERVICE PANEL (Ref. 12-13-01).

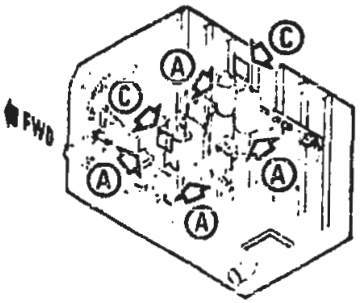
(9) Check valve and fitting for leakage.

(10) Check valve operation as follows:

(a) Pressurize applicable system; observe and note SYS (applicable) RESERVOIR PRESSURE on HYDRAULIC SERVICE PANEL, zone 147.







RESERVOIR SERVICE INSTRUCTIONS

NOTICE: RESERVOIR GAGE WILL SHOW TRUE QUANTITY OF FLUID ONLY WHEN SYSTEM IS PRESSURIZED & DIAL SET AT FLUID TEMPERATURE

FLUID QUANTITY CHECK

- PRESSURIZE HYDRAULIC SYSTEM PER SERVICE PANEL INSTRUCTIONS
- OBSERVE SYSTEM FLUID TEMPERATURE ON SERVICE PANEL GAGE
- TURN RESERVOIR DIAL TO FLUID TEMPERATURE WHICH WAS OBSERVED
- IF DIAL NEEDLE IS: IN **RED** ZONE, - PERFORM **FILL** AS NOTED BELOW
  IN **GREEN** ZONE, - PERFORM **AIR CHECK**
  IN **YELLOW** ZONE, - PERFORM **OVERFILL DRAIN**

FILL

- CONNECT GROUND SERVICE CART TO SERVICE PANEL COUPLING
- PRESSURIZE HYDRAULIC SYSTEM PER SERVICE PANEL INSTRUCTIONS
- TURN RESERVOIR DIAL TO FLUID TEMPERATURE
- FILL AT ABOUT 1.0 GPM UNTIL RESERVOIR DIAL NEEDLE IS AT **FULL**

AIR CHECK

- PRESSURIZE HYDRAULIC SYSTEM PER SERVICE PANEL INSTRUCTIONS
- TURN RESERVOIR DIAL TO ALIGN LEFT DOT IN GREEN ZONE WITH NEEDLE
- WHILE OBSERVING DIAL OPERATE DEPRESSURIZATION VALVE AT BASE
  - IF ROTARY VALVE, TURN RAPIDLY 60° TO STOP & RELEASE
  - IF PUSH BUTTON VALVE, DEPRESS FULLY & RELEASE
- IF NEEDLE SWEEPS PAST ANOTHER DOT, PERFORM **AIR BLEED** BELOW

AIR BLEED

- CONNECT TRANSPARENT HOSE TO AIR BLEED VALVE NIPPLE
- PRESSURIZE HYDRAULIC SYSTEM PER SERVICE PANEL INSTRUCTIONS
- DEPRESS AIR BLEED VALVE BUTTON UNTIL FLUID IN HOSE RUNS CLEAR
- PERFORM **AIR QUANTITY** AND **FLUID QUANTITY CHECKS**

OVERFILL DRAIN

- SET RESERVOIR DIAL AT FLUID TEMPERATURE. PERFORM **AIR BLEED** EXCEPT DEPRESS BUTTON UNTIL GAGE NEEDLE IS AT **FULL** MARK

Ⓒ
RESERVOIR SERVICE INSTRUCTIONS PLACARD (TYP 2 PLACES)

M1-0100-29-376

Reservoir Depressurization Valve - Removal and Installation
Figure 1

(b) Position valve to RSVR DEPRESS and verify that SYS RESERVOIR PRESSURE gage goes toward zero psig.

(11) Turn off hydraulic pressure.

(12) Verify that the reservoir fluid supply is at proper level (Ref. 12-13-01).

(13) Close and lock hydraulic service center doors 147AB and 1478B.

NO. 2 ENGINE-DRIVEN HYDRAULIC PUMP RIPPLE DAMPER REMOVAL AND INSTALLATION

1. Equipment and Materials

   Fluid Container

   Protective Plugs

   Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

   Packing (O-ring) NAS 1612-12, or equivalent

2. Referenced Procedures

   12-13-01 Hydraulic Fluid Replenishing

   29-11-00 Hydraulic Power System - Maintenance Practices

   71-00-00 Power Plant - Adjustment and Test

3. Removal/Installation

   A. Removal

      (1) Verify that the applicable B or C hydraulic system pressure and reservoir pressure is zero psi (29-11-00).

      (2) Open cowl panels 433 and 434 for engine No. 2.

      (3) Locate applicable system ripple damper, system B in upper left side, system C in upper right side, mounted on aft side of canted bulkhead, outboard of the high pressure filter (Ref. Fig. 401).

R CAUTION: USE EXTREME CARE TO PREVENT DAMAGE TO HOSES FROM
R BENDING OR KINKING DURING RIPPLE DAMPER REMOVAL.

      (4) Position fluid container to catch fluid drainage.

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
R HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR
R PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF.
R 29-11-00,201).

      (5) Disconnect pump pressure flex hose fitting at top of ripple damper. Install protective plug on hose fitting to minimize fluid drainage.

(6) Loosen both hydraulic fittings of tube between ripple damper and filter module.

(7) Disconnect hydraulic connector from ripple damper lower fitting and rotate tube assembly away to provide clearance.

(8) Install plug in tube connector to stop fluid drainage and temporarily tighten fitting at filter.

(9) Remove adapter fittings from ripple damper and retain for reinstallation. Discard O-ring packings.

(10) Remove ripple damper mounting bolts and retain for reinstallation. Remove ripple damper from aircraft.

B. Installation

(1) Verify that ripple damper ports are clean.

(2) Install new packings on adapter fittings lubricated with clean hydraulic fluid.

(3) Install adapter fittings in ripple damper.

(4) Position ripple damper in place and install mounting bolts.

(5) Remove protective plug from tube hydraulic fitting, loosen connector at filter and rotate into position and attach connector to ripple damper.

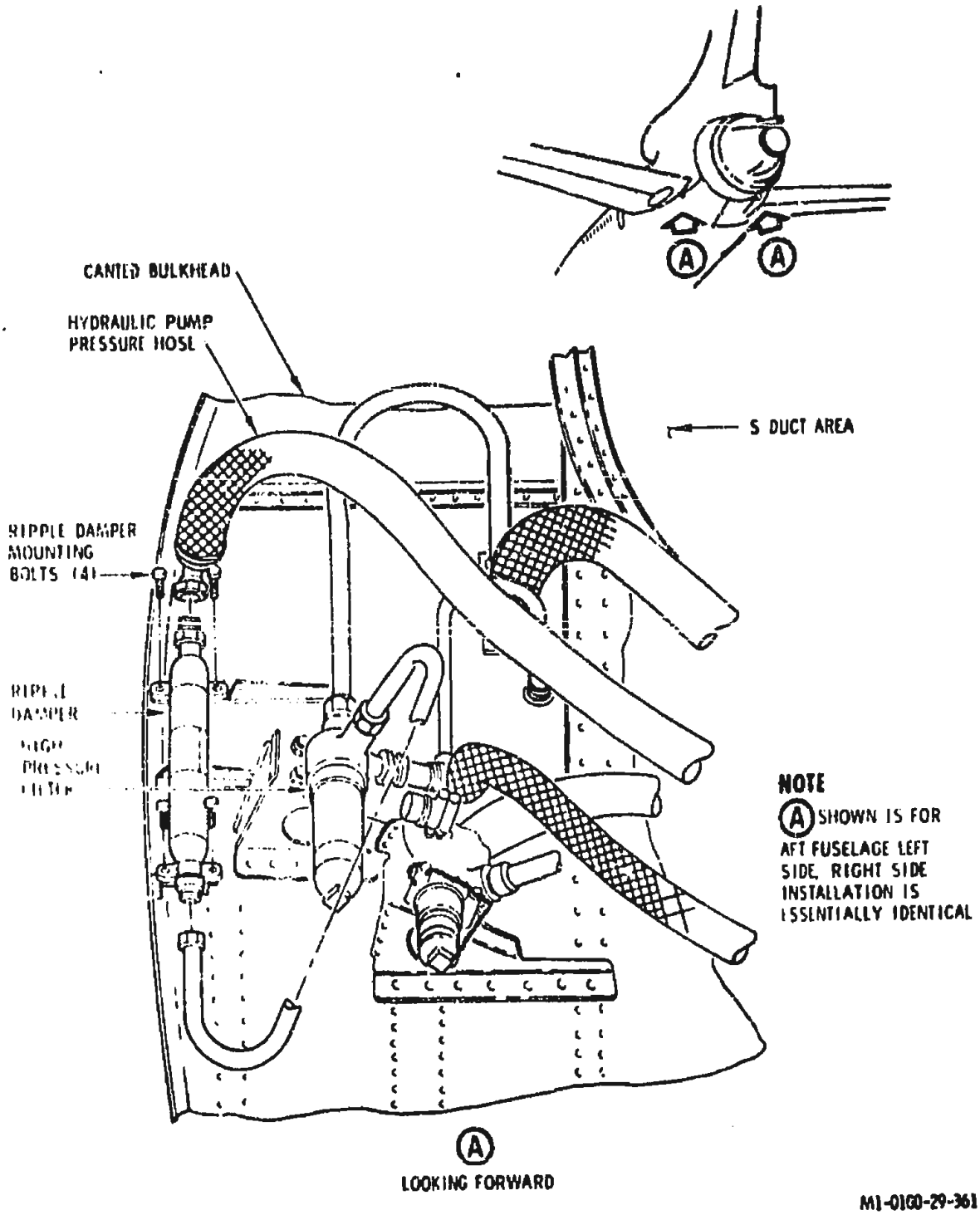
(6) Tighten both connectors on tube assembly.

R CAUTION: USE EXTREME CARE TO PREVENT BENDING, KINKING OR
R INTRODUCING A TWISTING PRELOAD IN THE HOSE WHEN
R TIGHTENING FITTINGS.

(7) Remove protective plug from pump pressure hose connector, attach to ripple damper and tighten.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.



R No. 2 Engine-driven Hydraulic Pump Ripple Damper
R Removal and Installation
R Figure 401

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on electrical power (24-41-00).

(9) Perform system air bleed as follows:

(a) On the pilots overhead panel, position the PFCS panel RUDDER, STABILIZER, AILERON, and SPOILER switchlights (released out) to OFF or INOP.

NOTE: Flight control servos are shut off to prevent air movement into flight control system.

(b) Motor engine No. 2 (71-00-00). During engine motoring, operate controls applicable to system in which ripple damper was replaced as follows:

System B, operate B-A PTU and flaps (1 cycle)

System C, operate flaps (1 cycle)

(c) Stop engine motoring (71-00-00).

(10) Check all hydraulic lines and fittings at ripple damper and filter module for evidence of leakage.

(11) Perform reservoir AIR CHECK and reservoir AIR BLEED in accordance with instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placards, zone 147.

(12) Turn off electrical power (24-41-00).

(13) Close and lock cowl panels.

(14) Close and lock hydraulic service center doors.

R ATM LUBE PRESSURE SWITCH - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R O-ring, M83248-1-904 or equivalent

R ATM Oil

R Lock-wire, Fed Spec QQ-W-390, 0.020-inch diameter, or equivalent

R Container, one quart capacity, or equivalent

R Splice, Wire Crimp, Sunstrand P/N 54373-1, or equivalent

R Protective plug to fit switch boss

R Marker, Branch Identification, Sunstrand P/N 54375-13, or
R equivalent

R Wire splice crimping tool AMP P/N 46074, or equivalent

R Splice covers, Sunstrand P/N 54374-3, or equivalent

R 2. Referenced Procedures

R	6-40-00	Exterior Access Doors ard Panels
R	29-11-00	Hydraulic Power System - Maintenance Practices
R	29-11-39	Air Turbine Motor - Adjustment and Test

R 3. Removal/Installation

R A. Removal

R (1) Turn off applicable hydraulic system B or C pressure
R and depressurize reservoir system to reduce hydraulic
R pressure to 0 psi (Ref. 29-11-00).

R (2) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, open and tag applicable
R circuit breaker ATM PUMP CONT & IND SYS B or SYS C (L13
R or L19.)

R (3) On Flight Engineer/Second Officers HYDRAULIC SYSTEM
R control panel, zone 215, verify that ATM switch for
R applicable system B or C is in OFF position. Tag
R switch.

R (4) Remove access panel 195D for system B or panel 196D for
R system C panel as applicable (Ref. 6-40-00.)

R (5) Position container to catch spilling ATM oil and remove
R switch (Ref. Fig. 401).

R (6) Install plug in switch boss to prevent contamination,
R if required.

R (7) Cut switch wires at a convenient point for splicing new
R switch.

R B. Installation

R (1) Verify that applicable hydraulic system B or C pressure
R is 0 psi.

R (2) Verify that circuit breaker opened in Step A(2) is open
R and tagged.

R (3) Verify that switch called out in Step A(3) is in OFF
R position.

R (4) Measure and cut replacement lube pressure switch wires
R approximately one-inch longer than wires on old switch.

R NOTE: Additional length is required to accommodate the
R staggered splices. Staggered splices minimize
R danger of shorting.

R (5) Cut to length and strip insulation from wire ends on
R pressure switch and wire harness leads (Ref. Fig. 402).

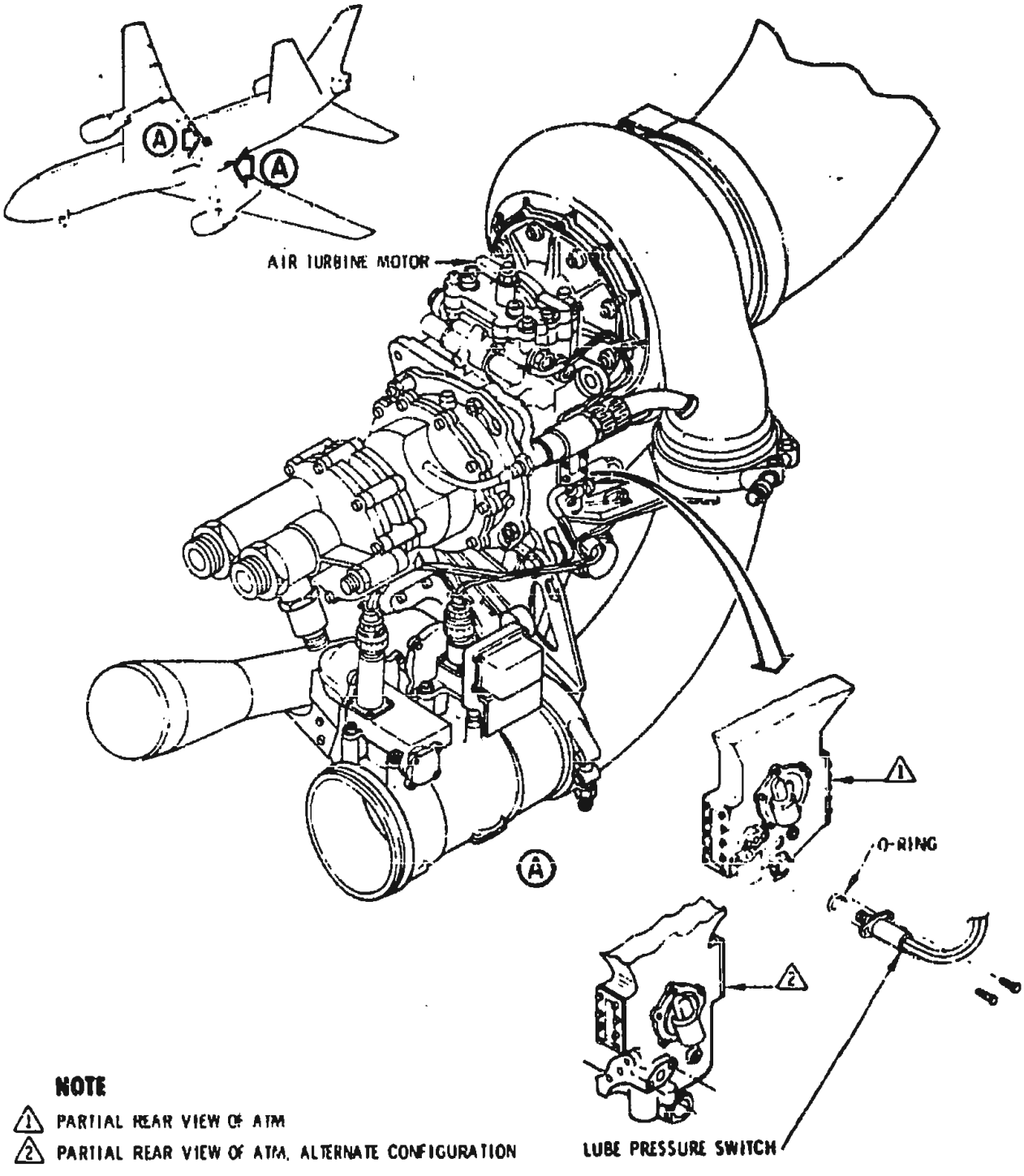
R (6) Slide properly marked branch identification marker over
R braided wire bundle.

R (7) Slide wire splice covers over long lead of each wire
R and crimp splice wire ends together.

R (8) Slide splice covers over each splice and shrink using a
R heat gun or other suitable source of flameless
R localized heat. The Teflon tubing must be heated to
R transparency before shrinking occurs (approximately
R 400° Fahrenheit). Excessive exposure to heat is to be
R avoided to prevent Teflon from rupturing as it cools.

R NOTE: This cover when in place must overlap wire
R insulation.

R (9) Slide branch marker over spliced wire bundle and
R shrink, using heat as noted above to shrink tubing into
R place.



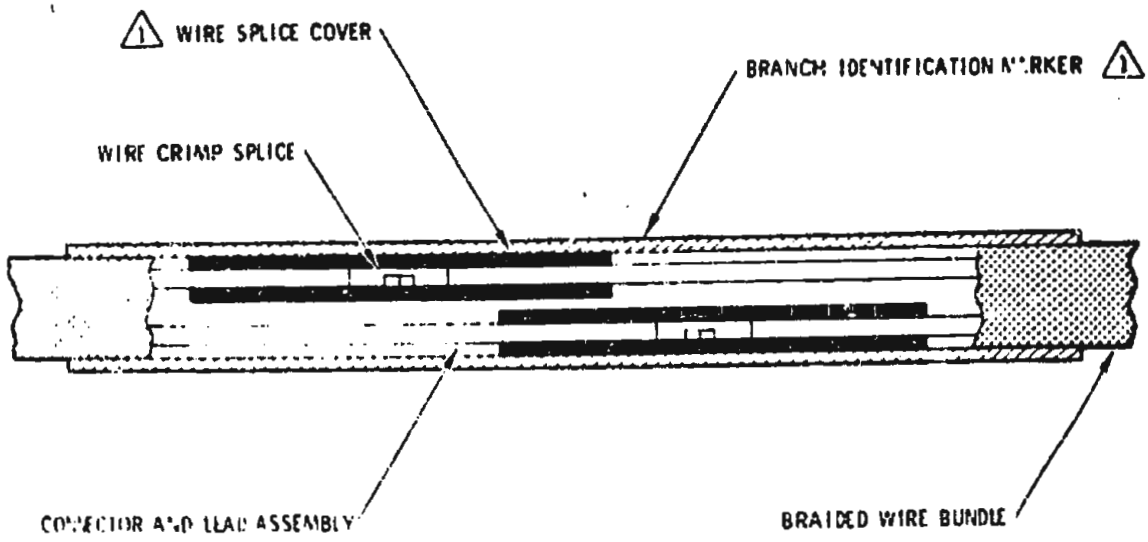
NOTE

1. PARTIAL REAR VIEW OF ATM
2. PARTIAL REAR VIEW OF ATM, ALTERNATE CONFIGURATION

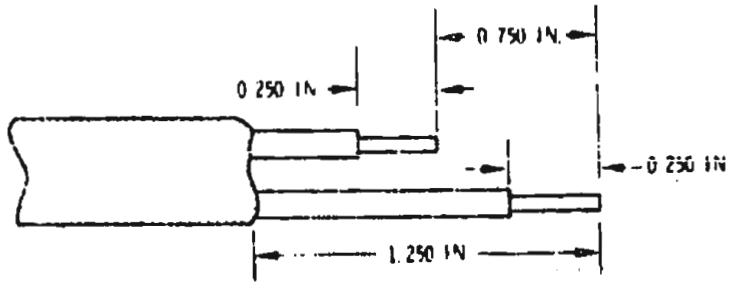
M1-0100-29-38C

R ATM Lube Pressure Switch - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B



WIRE SPLICE



WIRE TRIM DETAIL

NOTE

1 HEAT SHRINK PER TEXT

R ATM Lube Pressure Switch Wire Cutting and Splicing Details AVI-0100-29-381
R Figure 402

R EFFECTIVITY: ALL

001B

R R R NOTE: This branch marker, when in place, must overlap outer covering approximately 1/4-inch to prevent unraveling of braided wire bundle.

R (10) Replace switch O-ring.

R (11) Position container under switch boss and remove plug.

R R (12) Install switch with internal wrenching cap screws and torque 20-22 lb in.

R (13) Service ATM lube oil to top 1/2-inch of sight gauge.

R R (14) Perform air turbine motor adjustment and test (Ref. 29-11-39).

R (15) Install access panel.

RESERVOIR FILL SYSTEM - DESCRIPTION AND OPERATION

1. General

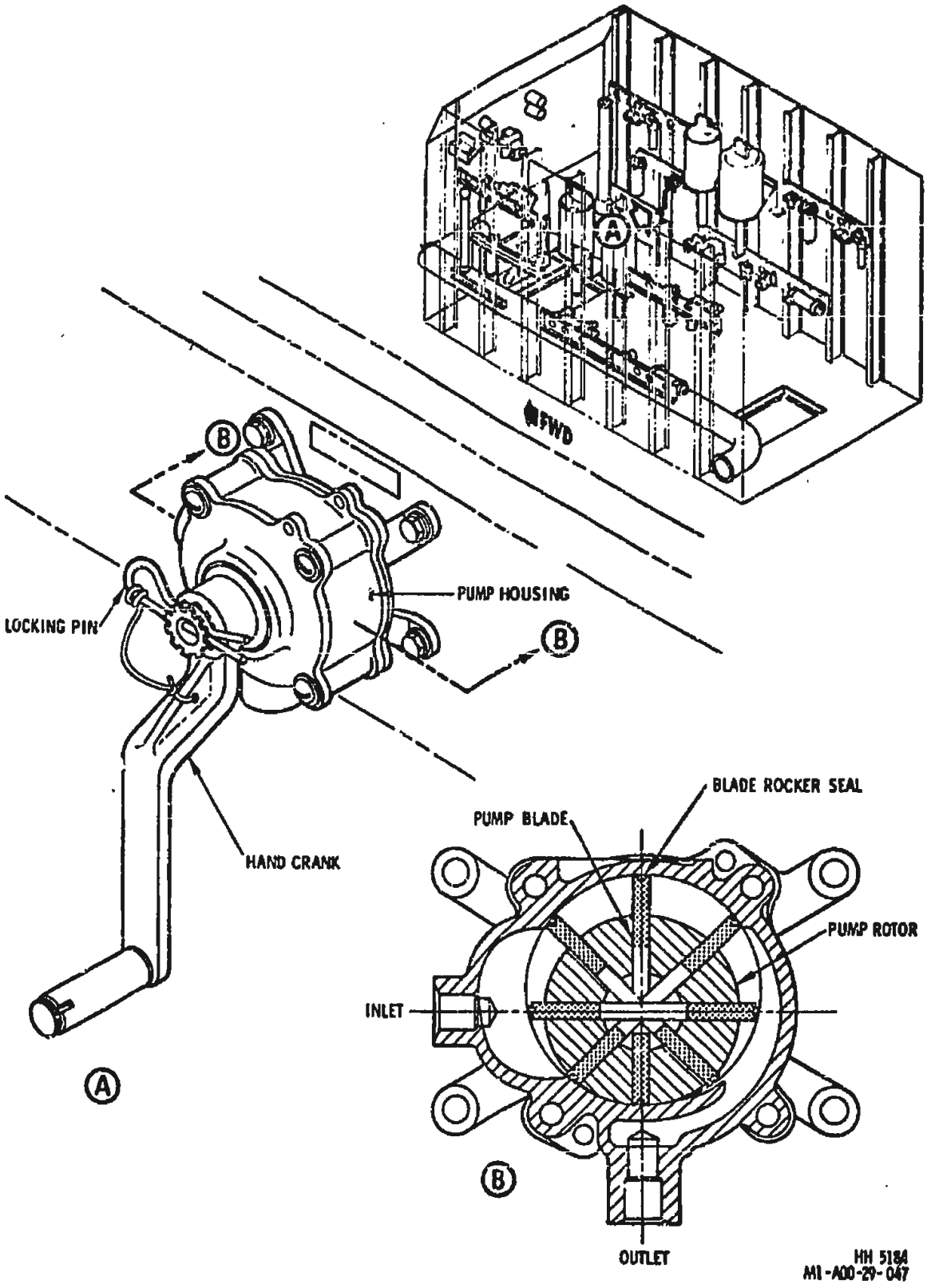
The reservoir fill system enables the reservoirs to be serviced from a ground servicing dolly or from hydraulic fluid cans using a hand pump. The HYDRAULIC SERVICE PANEL, zone 147, contains four quick disconnects (QD); one is connected to each of the four hydraulic systems (Ref. 29-11-00, Fig. 3). By connecting the hose and mating QD from a ground servicing dolly to the desired reservoir QD, fluid will be directed to the reservoir through the return filter module.

A rotary-type hand pump mounted on the right sidewall of the hydraulic service center (Ref. Fig. 1) can be used to add fluid to the reservoir if a ground servicing dolly is not available. The pump consists of a handcrank-driven rotary vane pumping element mounted in and supported by a three-piece housing. The element rotor contains eight axial slots into which four opposed sets of blades (vanes) are fitted. The rotor (with blades) is suspended in the center section of the housing by the end covers which form the support bearings. The center section of the housing serves as the pumping chamber. A close seal is maintained between the blades and the contours of the housing by the use of rockers fitted at the blade tips.

2. Operation

Because the attitude of the rotor is eccentric in relation to the centerline of the pumping chamber, the blade sets are forced to reciprocate in the rotor slots when the crank is turned. Internally, the inlet and discharge ports are located on opposite sides of the pumping chamber. In operation, the sectors between adjacent blade sets increase in size at the inlet ports which results in a partial vacuum that fills with hydraulic fluid. At the discharge side, the sector decreases in size and the fluid is forced out of the chamber through a passage to the discharge port. The pump discharges 6.4 cubic inches per revolution, or a flow rate of 2 gpm at 95 rpm at 50 psi and a torque of 95 pound-inches. At higher pressures, capacity is 1 gpm at 70 rpm at 150 psi and a torque of 260 pound-inches.

R Hoses with QD fittings connect the pump outlet to the QD
R fittings on the HYDRAULIC SERVICE PANEL and on the pump inlet to
R a ground support equipment adapter which is inserted into the hydraulic fluid supply containers (Ref. 12-13-01).



Hand-operated Low-pressure Hydraulic Pump (Reservoir Fill)
Figure 1

HAND-OPERATED LOW-PRESSURE HYDRAULIC PUMP (RESERVOIR FILL) REMOVAL AND INSTALLATION

1. Equipment and Materials

   Packing (O-ring), NAS1612-6, or equivalent

R Hydraulic Fluid, Lockheed Spec C-34-1224, or equivalent

2. Removal/Installation

   A. Removal

      (1) Remove hoses and adapters from hand pump ports (Ref. Fig. 401). Discard packings (O-rings).

      (2) Remove mounting bolts and washers.

      (3) Remove pump from mounting structure.

   B. Installation

      (1) Pour hydraulic fluid into inlet port and rotate pump handle to wet all internal parts of pump with fluid (Ref. Fig. 401).

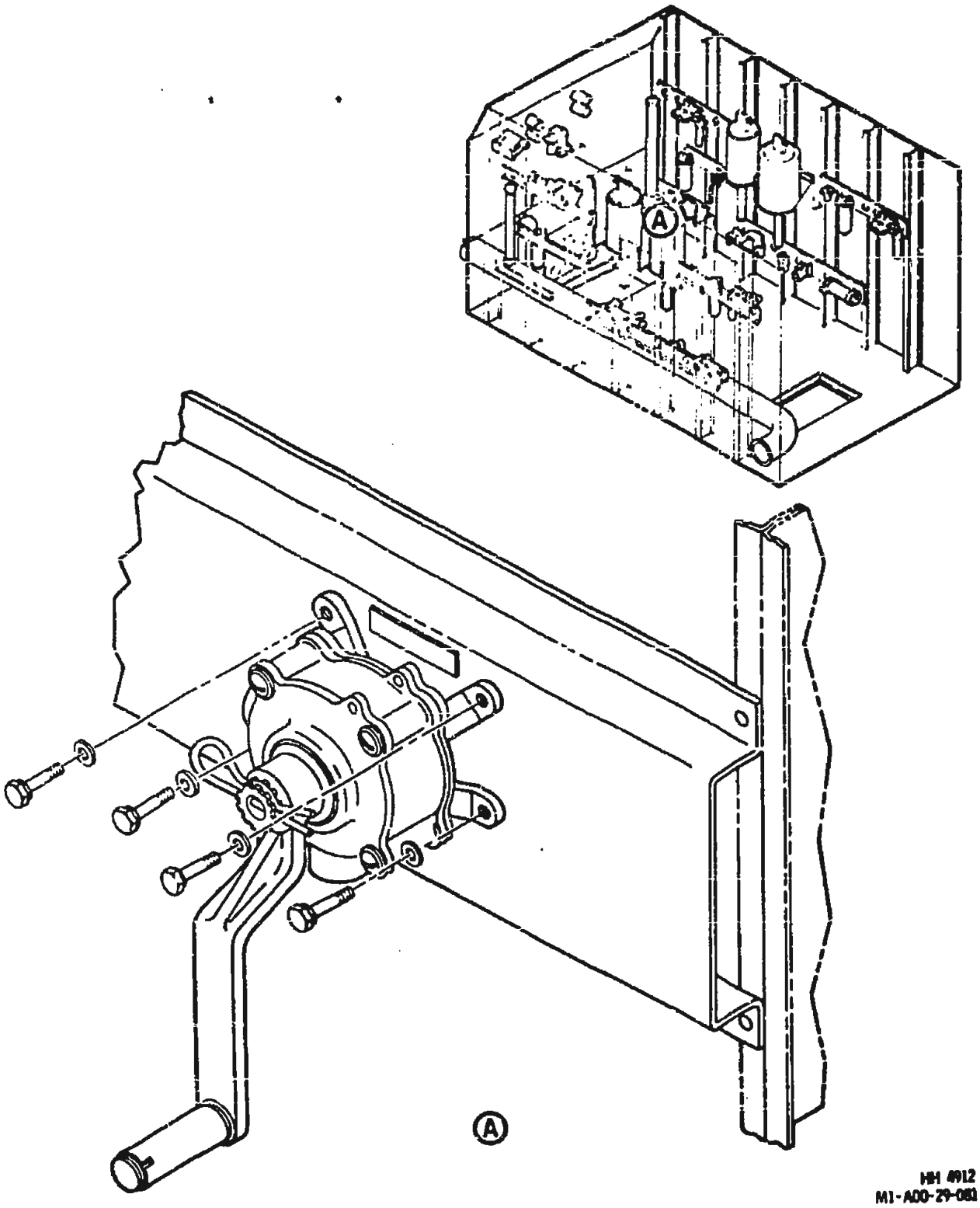
      (2) Install new packings (O-rings) on adapter fitting and check valve fitting, lubricating with hydraulic fluid.

      (3) Install adapter fitting into inlet port of pump.

      (4) Install check valve into outlet port of pump.

      (5) Position pump on mounting structure with outlet port (check valve) pointing downward. Install mounting bolts and washers.

      (6) Connect hose assemblies to adapter and check valve fittings.



Hand-operated Low-pressure Hydraulic Pump (Reservoir Fill)
Removal and Installation
Figure 401

HYDRAULIC RESERVOIR AUXILIARY PRESSURIZATION SYSTEM DESCRIPTION AND OPERATION

1. General

The bootstrap reservoirs in the hydraulic systems are pressurized by system pressure to provide suction line pressure to the hydraulic pumps. During pump operation in the depressurized mode (EDV) with no system pressure there would be no pump suction line pressure. To prevent this condition, an auxiliary reservoir pressurization system is provided.

The system consists of a priority valve in the high-pressure filter-module and an accumulator in the line providing pressure to the reservoir pressurization piston (Ref. Fig. 1). The pressure and volume of fluid in the accumulator provides reservoir pressurization during the remainder of a flight in which the pump must be placed in the EDV mode.

System B contains a manifolded check valve module in the reservoir/accumulator circuit to provide the ram air turbine (RAT) with warm oil bleed and reservoir pressurization during RAT deployment (Ref. 29-21-00).

2. Hydraulic Reservoir Auxiliary Pressurization Accumulator

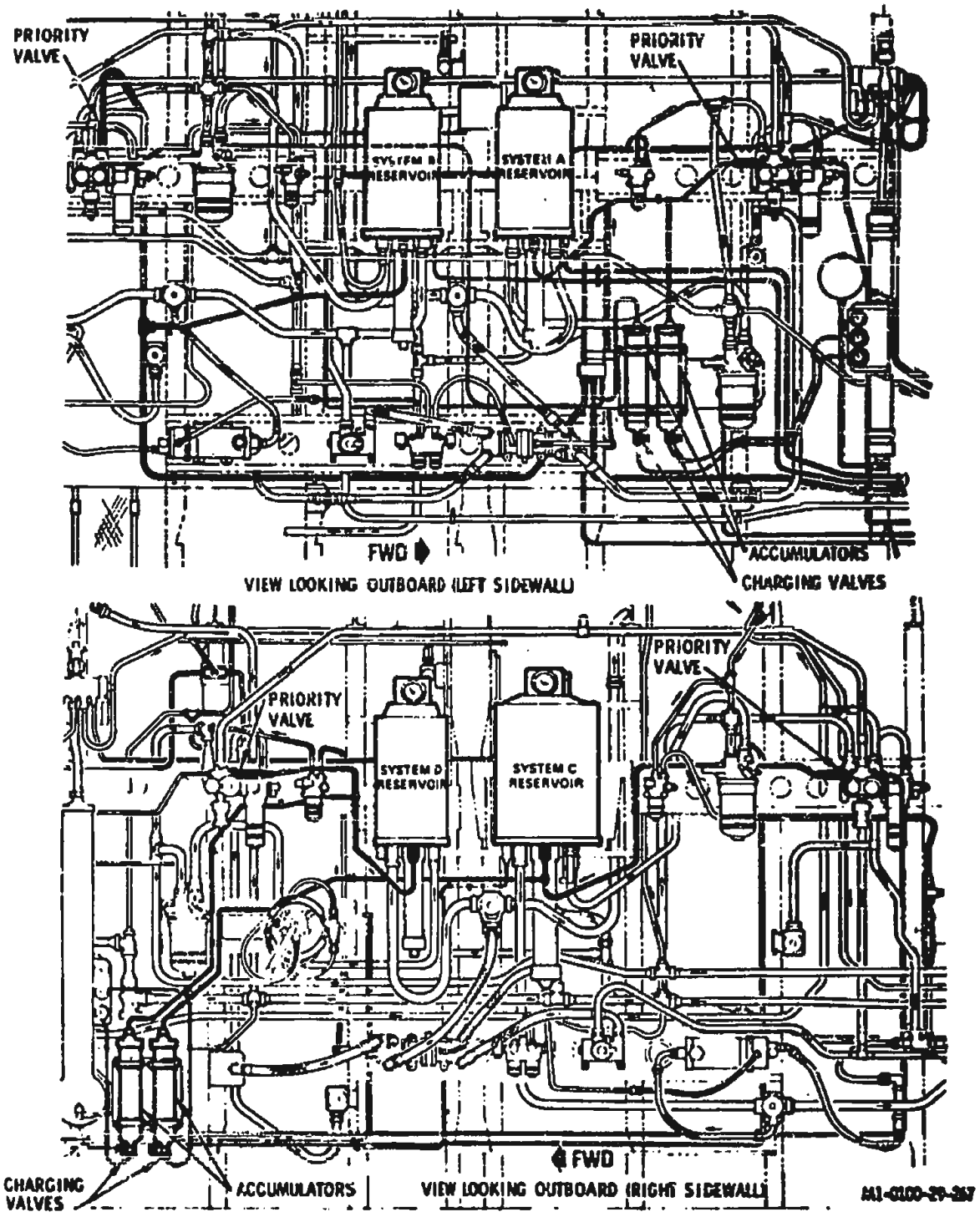
A. Description

Four reservoir auxiliary pressurization accumulators are installed on the hydraulic service center sidewalls near the brake accumulators. The gas charge pressure gages for the reservoir accumulators are installed in a panel also containing the brake accumulator pressure gage.

The accumulators are 75-cubic inch, piston type, approximately 3 inches in diameter and 19 inches in length (Ref. Fig. 2). A gas charging valve is installed in the lower cap fitting. The upper cap hydraulic fitting and line directs the hydraulic fluid to the reservoir pressurization line. A gas precharge pressure versus temperature chart is mounted on each accumulator.

B. Operation

A priority valve installed in the high-pressure filter module reservoir pressurization port controls system pressure and fluid flow to the reservoir bootstrap piston and accumulator. In the event that an engine-driven hydraulic pump is placed in a depressurized mode (EDV), the



Hydraulic Reservoir Auxiliary Pressurization System
Figure 1

accumulator pressure maintains reservoir pressurization, thereby providing suction pressure for the pumps during EDV operation.

The accumulators are precharged with a gas pressure of approximately 500 psi at ambient temperature of 80 degrees F (26.7 degrees C) with the hydraulic system at zero psi.

Prior to any maintenance operations necessitating opening of any hydraulic lines or component fittings, the applicable system accumulator must be discharged. This is accomplished by operating the depressurization valve at the base of the reservoir until the reservoir pressure gage on the HYDRAULIC SERVICE PANEL indicates zero psi.

3. Hydraulic Reservoir Auxiliary Pressurization Priority Valve

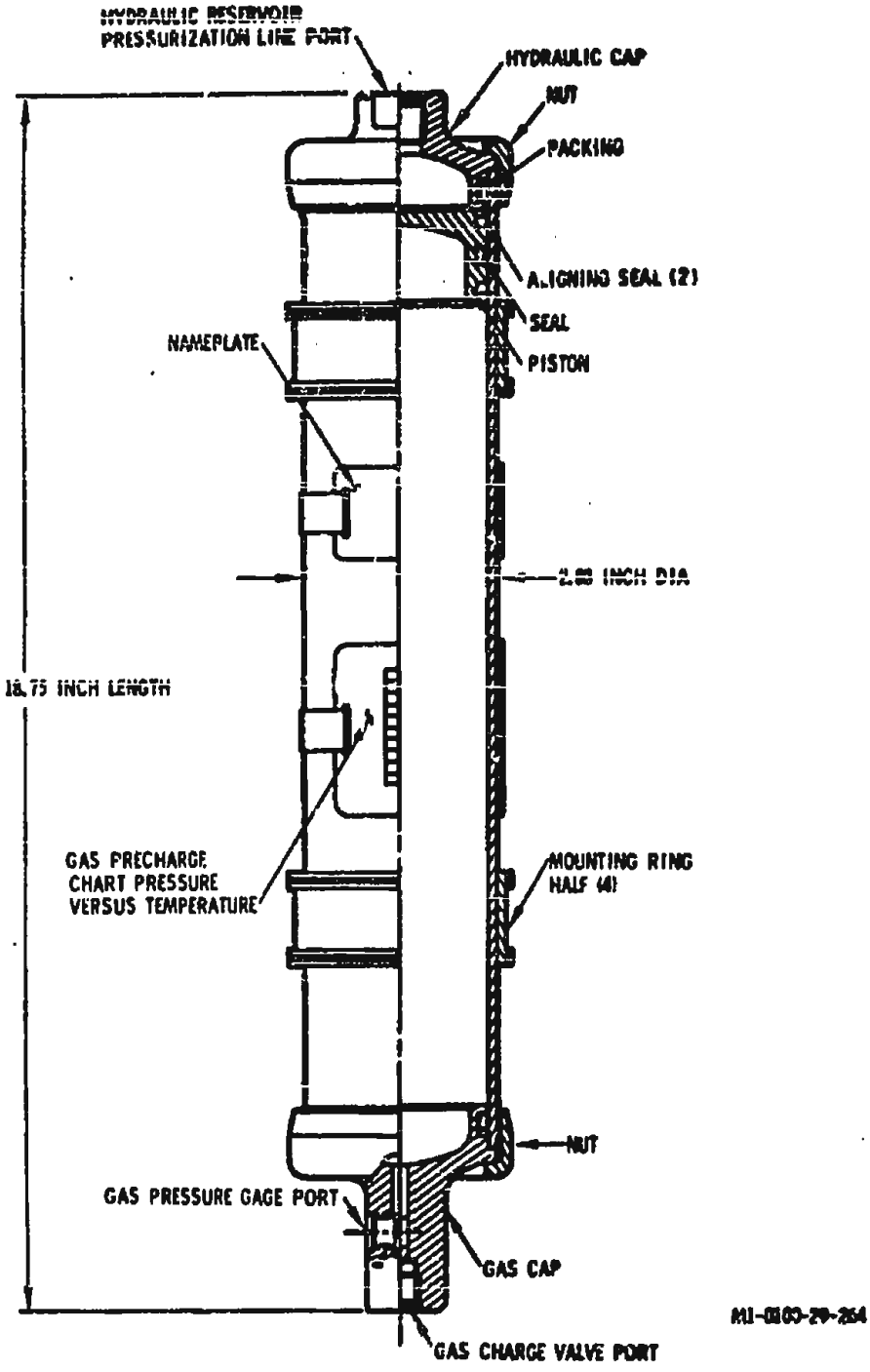
A. Description

A priority valve is installed in the high-pressure filter module reservoir pressurization line port for systems A, C, and D (Ref. Fig. 3). The valves are identical and are positioned horizontally with the flow arrow directed toward the reservoir pressurization piston. The valves are approximately 5-1/2 inches long and 1 inch in diameter. The flow rate of the valve is 1-1/2 gpm.

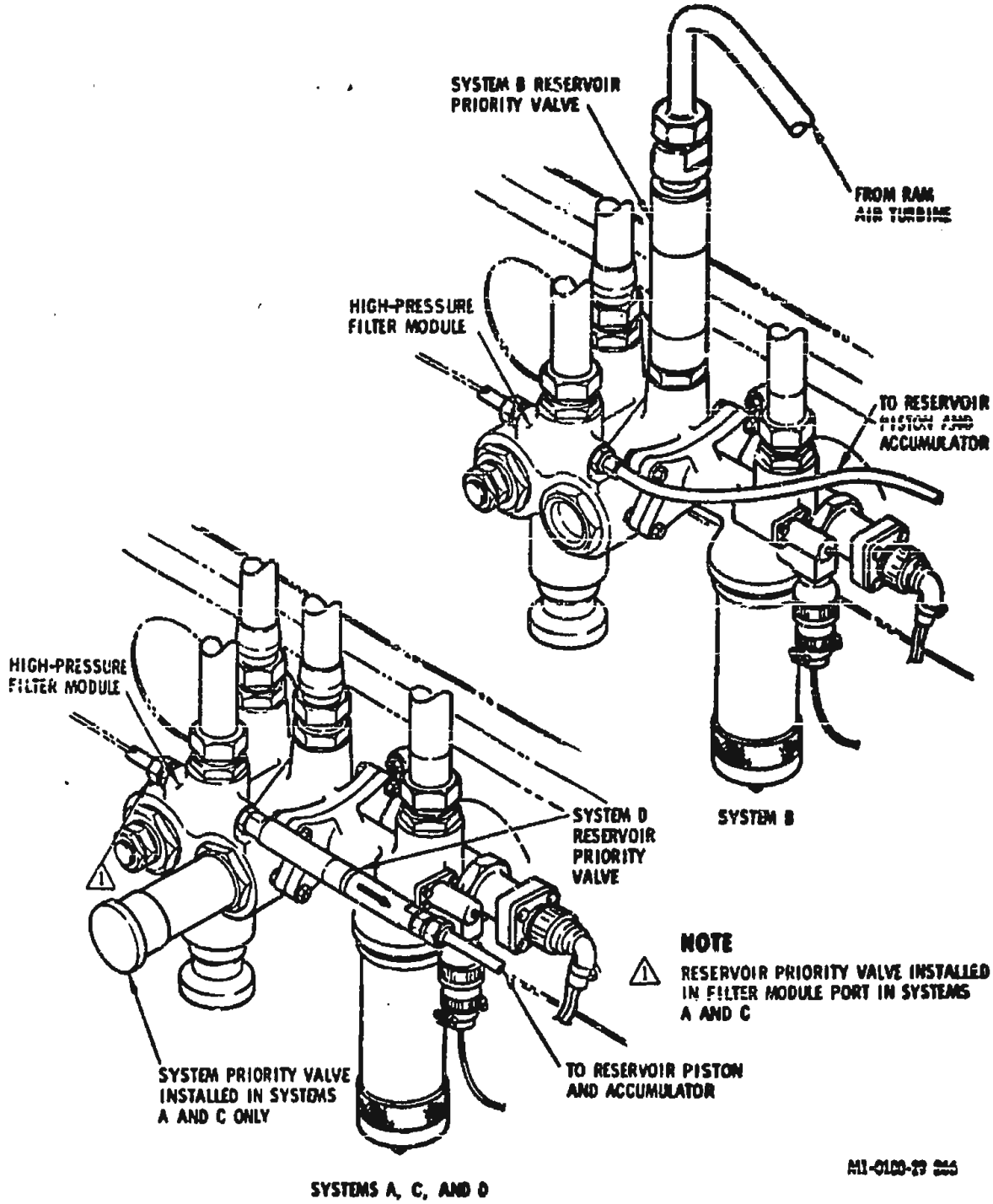
System B priority valve is mounted vertically in the filter module and is larger, with a flow rate of 15 gpm. The valve provides priority pressure from the RAT pump output to the reservoir pressurization piston before going into system B through the valve. An additional line from the high-pressure filter module directs system pressure through the manifolded check valve module and then to the accumulator, RAT and reservoir pressurization piston (Ref. 29-21-00).

B. Operation

The priority valve is essentially a relief valve with a spring-loaded poppet seated against a spring-loaded piston/seat. Pressure will free flow in one direction (to the accumulator) but will be trapped by the relief valve in the opposite direction until sufficient pressure is exerted against the spring-loaded piston/seat to move it away from the poppet. As additional fluid volume, from system actuating cylinder operation, returns to the reservoir, the priority valve will open to allow the pressurization piston to move. As system pressure decays (pump placed in EDV mode) the priority valve retains hydraulic pressure and fluid in the accumulator (approximately 1900 psig).



Hydraulic Reservoir Auxiliary Pressurization Accumulator
Figure 2


SYSTEM B RESERVOIR PRIORITY VALVE
FROM RAM AIR TURBINE
HIGH-PRESSURE FILTER MODULE
TO RESERVOIR PISTON AND ACCUMULATOR
SYSTEM B
HIGH-PRESSURE FILTER MODULE
SYSTEM D RESERVOIR PRIORITY VALVE
NOTE
RESERVOIR PRIORITY VALVE INSTALLED IN FILTER MODULE PORT IN SYSTEMS A AND C
SYSTEM PRIORITY VALVE INSTALLED IN SYSTEMS A AND C ONLY
TO RESERVOIR PISTON AND ACCUMULATOR
SYSTEMS A, C, AND D

Hydraulic Reservoir Auxiliary Pressurization Priority Valves
Figure 3

HYDRAULIC RESERVOIR AUXILIARY PRESSURIZATION CYLINDRICAL ACCUMULATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Hydraulic Fluid LAC Spec C-34-1224, or equivalent

Packing Seal (O-ring) NAS1612-6, -8

Fluid Container, 3-gallon plastic pail or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Bootstrap Reservoir - Servicing
12-14-16	Hydraulic Reservoir Auxiliary - Pressurization Accumulator Charging
24-41-00	External Power/Ground Servicing System - Maintenance Practices
29-11-00	Hydraulic Power Systems - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: PRIOR TO MAINTENANCE PROCEDURES IN OR NEAR HYDRAULIC SERVICE CENTER, VERIFY THAT THE RAM AIR TURBINE (RAT) GROUND SAFETY LOCK IS INSTALLED OVER THE RAT DOORS.

CAUTION: OBSERVE WARNING AND CAUTION INSTRUCTIONS FOR HYDRAULIC FLUID HANDLING, REFERENCE MAINTENANCE MANUAL 29-00-00, MAINTENANCE PRACTICES.

NOTE: Observe standard practices to prevent contamination of hydraulic system fluid during modification operation. Use protective caps on opened lines and component fittings to be reinstalled or reconnected in the hydraulic system.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag the following circuit breakers:

ATM PUMP - CONT & IND - SYS B (L13)

PTU - CONT & IND - SYS B-A (L14)

PTU - CONT & IND - SYS C-D (L15)

ATM PUMP - CONT & IND - SYS C (L19)

RUDDER FUSING SYS (L16)

AC PUMP - B3 (L12)

AC PUMP - C3 (L22)

(2) Open hydraulic service center access doors 147AB and 147BB.

(3) Ensure that all hydraulic systems are shut off, (Ref. 29-11-00); tag HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147, to prevent pressurization of any system during modification.

(4) Prior to opening any plumbing line, depressurize reservoir and accumulator (Ref. 29-11-00).

NOTE: Use plastic bucket or other suitable container to catch fluid when lines are opened.

(5) At the applicable system accumulator, remove dust cap from charging valve (Ref. Fig. 401).

R WARNING: USE CAUTION WHEN BLEEDING OFF AIR CHARGE FROM ACCUMULATOR. HYDRAULIC FLUID MAY BE PRESENT. COVER CHARGING VALVE WITH A CLOTH TO CONTAIN POSSIBLE FLUID SPRAY.

(6) Remove air/nitrogen charge from accumulator by depressing charging valve stem.

(7) Disconnect pressure gage line connector from bottom part of accumulator.

(8) Disconnect hydraulic line connector from adapter at top of accumulator. Install protective caps and plugs on ports and fittings.

(9) Remove screws, nuts and washers from mounting clamps and remove accumulator from bracket. Retain for reinstallation.

(10) Remove adapter (expander) from hydraulic port and discard packing (O-ring).

(11) Remove air charging valve from side port at lower end of accumulator and discard packing (O-ring).

B. Installation

(1) Verify that circuit breakers opened and tagged in Step 3A(1) are as required.

(2) Verify that control panel tags installed in Step 3A(3) to prevent system pressurization are in place.

(3) Install packing seal o-rings on the air-change valve and the two adapter fittings. Lubricate O-rings with hydraulic fluid.

(4) Prior to accumulator installation, pour approximately 8 oz (1/2 pint) of clean hydraulic fluid into each port of the accumulator and rotate to thoroughly wet the interior and then drain all fluid out.

(5) Install air-dharging valve in side port of the gas cap end and tighten.

(6) Install adapter fittings in the hydraulic and gas cap ports.

(7) Position mounting clamps in place and mount accumulator to mounting bracket using screws, nuts and washers retained during removal [Step 3A(9)].

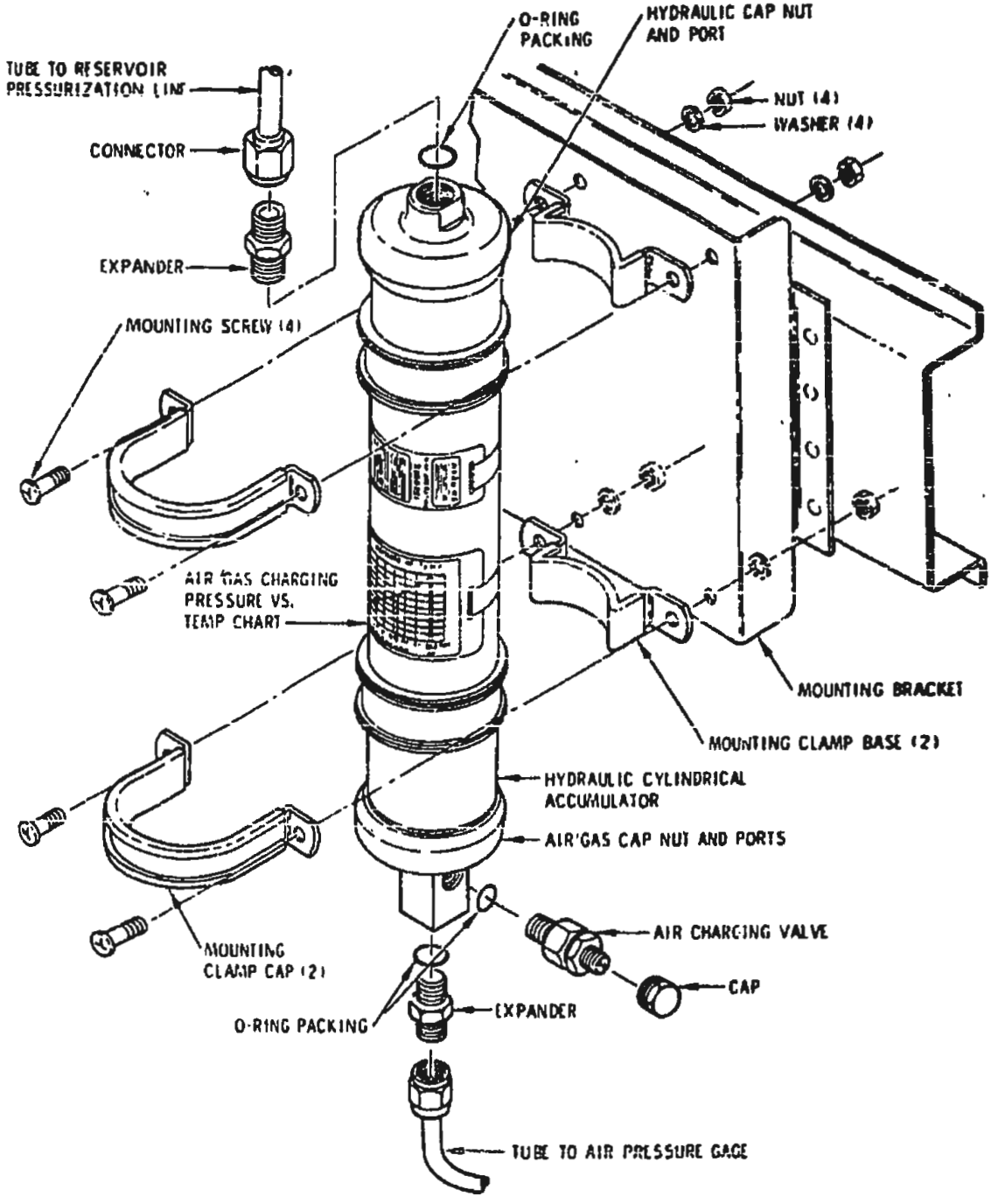
(8) Verify that air-charging valve and servicing gas precharge pressure versus temperature chart are in accessible position then tighten the four mounting screws and nuts.

(9) Remove protective plugs from hydraulic and air pressure gage line connectors, and connect to accumulator adapter fittings.

(10) Perform air/nitrogen servicing of the accumulator (Ref. 12-14-16).

(11) Bleed system of air as follows:

(a) Verify that the applicable system reservoir fluid level is as required, replenish if necessary (Ref. 12-13-01).



MI-0100-29-274

Hydraulic Cylindrical Accumulator - Removal and Installation
Figure 401

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(b) Pressurize the applicable system and check fittings for leakage; shut off hydraulic power source.

(c) Depress reservoir depressurization valve until applicable SYSTEM and RESERVOIR PRESSURE gages on the HYDRAULIC SERVICE PANEL, zone 147, indicate zero psi.

(d) Repeat Steps (b) and (c) three times and perform RESERVOIR AIR CHECK in accordance with instructions on RESERVOIR SERVICING INSTRUCTIONS placard (Ref. 12-13-01).

(12) Turn off hydraulic power (Ref. 29-11-00).

(13) Turn off electrical power (24-41-00).

(14) Close and lock hydraulic service center access doors.

HYDRAULIC RESERVOIR AUXILIARY PRESSURIZATION PRIORITY VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

   Packing Seals (O-rings), NAS1612-6

   Protective Plugs and Caps

   Fluid Container, 3-gallon plastic pail, or equivalent

2. Referenced Procedures

12-13-01	Hydraulic Bootstrap Reservoir - Servicing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-16	Hydraulic Cylindrical Accumulator - Adjustment and Test

3. Removal/Installation

   A. Removal

      WARNING: PRIOR TO MAINTENANCE IN OR NEAR HYDRAULIC SERVICE CENTER, VERIFY THAT THE RAM AIR TURBINE (RAT) GROUND SAFETY LOCK IS INSTALLED OVER THE RAT DOORS.

      (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers ATM PUMP - CONT & IND - SYS B (L13), SYS C (L19) and AC PUMP - B3(L12), C3 (L22).

      (2) Open hydraulic service center doors 147AB and 147BB.

      (3) Verify that all hydraulic systems are shut off (Ref. 29-11-00); tag Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215 and the HYDRAULIC SERVICE PANEL, zone 147, to prevent system pressurization.

      (4) Prior to opening hydraulic line, depress applicable reservoir depressurization valve until SYS RESERVOIR PRESSURE gage on HYDRAULIC SERVICE PANEL indicates zero

psi (ensure that the valve stem fully extends when released).

(5) At the applicable high pressure filter module, hydraulic service center disconnect hydraulic connector from priority valve (Ref. Fig. 401).

NOTE: Use fluid container to catch fluid when lines are opened.

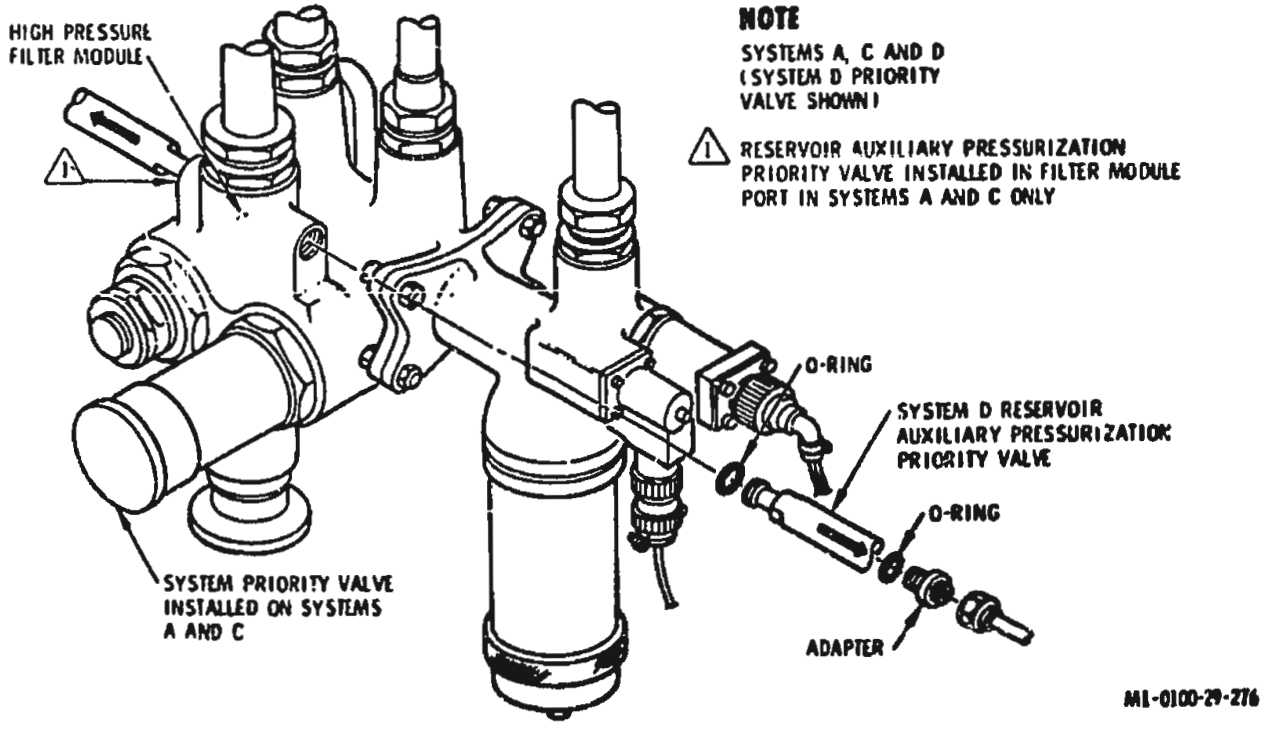
(6) Remove priority valve from high pressure filter module; discard O-ring packing.

(7) Remove adapter from priority valve and discard O-ring packing.

(8) Install protective plugs and caps on all open lines and ports if valve is not replaced immediately.

B. Installation

(1) Verify that applicable hydraulic system is shut off and tags are placed on control panels as noted in Step 3A(3).


HIGH PRESSURE FILTER MODULE
1
NOTE
SYSTEMS A, C AND D (SYSTEM D PRIORITY VALVE SHOWN)
1 RESERVOIR AUXILIARY PRESSURIZATION PRIORITY VALVE INSTALLED IN FILTER MODULE PORT IN SYSTEMS A AND C ONLY
O-RING
SYSTEM D RESERVOIR AUXILIARY PRESSURIZATION PRIORITY VALVE
O-RING
ADAPTER
SYSTEM PRIORITY VALVE INSTALLED ON SYSTEMS A AND C
MI-0100-29-276

Hydraulic Reservoir Auxiliary Pressurization Priority Valve
Removal and Installation
Figure 401

(2) Install new O-ring lubricated with hydraulic fluid on adapter and install adapter in priority valve port (Ref. Fig. 401).

(3) Install new O-ring lubricated with hydraulic fluid on priority valve; install valve in system B high pressure filter module and tighten.

(4) Connect hydraulic tube connector to priority valve adapter and tighten.

(5) Remove tags and close circuit breakers opened in Step 3 A(1).

(6) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC PRESSURE.

(7) Pressurize applicable hydraulic system (Ref. 29-11-00) and check the priority valve for leakage.

(8) Bleed system of air as follows:

(a) Depress system reservoir depressurization valve and hold for 30 seconds, release for 15 seconds. Repeat cycle 5 times minimum (insure that depressurization valve fully extends when released).

(9) Perform hydraulic reservoir auxiliary pressurization priority valve operational test (Ref. 29-13-03).

(10) Turn off hydraulic power (Ref. 29-11-00).

(11) Turn off electrical poer (Ref. 24-41-00).

(12) Close and lock hydraulic service center access doors 147AB and 147BB.

HYDRAULIC RESERVOIR AUXILIARY PRESSURIZATION PRIORITY VALVE ADJUSTMENT AND TEST

1. General

An operational test of the priority valve is performed as follows: verify that the accumulator has the required air/nitrogen change and then pressurize the hydraulic system; record accumulator pressure and verify that the priority valve functions properly to retain the pressure for a given time period.

2. Equipment and Materials

High pressure bottle dry gaseous nitrogen with pressure regulator and hose.

3. Referenced Procedures

12-14-16	Hydraulic Reservoir Auxiliary Pressurization Accumulator Charging
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Adjustment/Test

A. Operational Test

(1) Open hydraulic service center access doors 147AB and 147BB.

(2) On the HYDRAULIC SERVICE PANEL, zone 147, verify that applicable SYS PRESSURE gage reads zero psig.

R R (3) On aircraft with push-button type reservoir depressurization valve, depress and release system reservoir depressurization valve until SYS RESERVOIR PRESSURE gage reads zero psig (verify that the valve is fully released).

R R (3) On aircraft with lever type reservoir depressurization valve, rotate and release system reservoir depressurization

valve until SYS RESERVOIR PRESSURE gage reads zero psig (verify that the valve is fully released).

(4) Verify that the applicable system accumulator air/nitrogen pressure gage indicates 500 (±50) psig. Service as required (Ref. 12-14-16).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

RAT SAFETY LOCK IS INSTALLED ACROSS RAT DOORS

(5) Pressurize applicable hydraulic system (Ref. 29-11-00).

(6) Verify that the applicable accumulator air/nitrogen gage indicates approximately 3000 psig.

(7) Shut off the hydraulic pressure source and ensure that applicable system or any subsystem is not used for a period of 15 minutes.

R (8) For systems A, C, and D,
R verify applicable accumulator pressure drops rapidly to
R between 2550 and 1600 psig. Verify applicable
R accumulator pressure does not decay below 1500 psig
R during the 15-minute period.

R (8) For system B,
R verify applicable accumulator pressure drops rapidly to
R between 2550 and 1900 psig. Verify applicable
R accumulator pressure does not decay below 1500 psig
R during the 15-minute period.

(9) Close and lock the hydraulic service center access door.

RAM AIR TURBINE (RAT) SYSTEM - DESCRIPTION AND OPERATION

1. General

The RAT system provides the capability of supplying auxiliary hydraulic power to system B. The RAT deploys automatically in flight with all engines out or all hydraulic system pump switches in off position, or upon command from the Flight Engineer/Second Officer HYDRAULIC SYSTEM control panel switch. System B provides hydraulic power to the flight control systems necessary to maintain flight and landing control.

R The RAT system consists of a ram air turbine/pump unit mounted
R on a trunnion pivoted support leg, a dual-redundant uplock
R actuator (electric motor/squib actuator released), an oil
R dampened spring actuator, and a control module (Ref. Fig. 1).

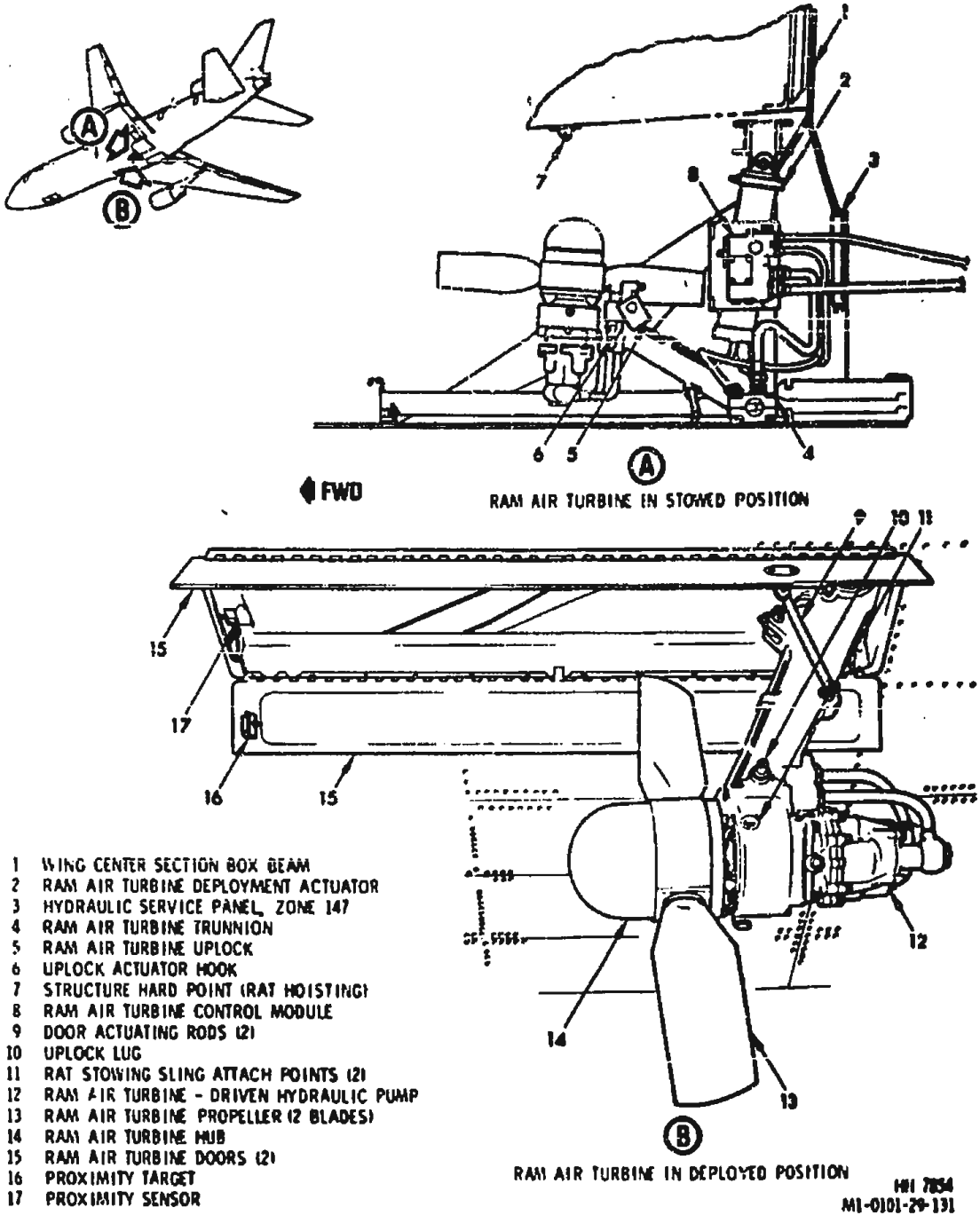
The RAT is stowed in the area below the wing center-section boxbeam on the aircraft centerline, zone 142. The RAT pivot point is at FS 1205, approximately 20 inches forward of the hydraulic service center forward access door.

2. Operation

Deployment of the RAT into the airstream (in flight) can be
R initiated by either of two methods: manually from a guarded
R switchlight, or automatically by an all-engines-out signal
R initiated by switches on the N3 tachometers (5500 rpm or less)
R or all four hydraulic pumps depressurized and both ATM control
R switches in the OFF position (Ref. Fig. 2).

A caution and warning annunciator light (RAT DEPLOYED) on the pilots panel indicates when the RAT is deployed in flight. Manual deployment is initiated by the guarded RAM AIR TURBINE momentary-type switchlight (UNLKD/PRESS) located on the Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215. The UNLKD portion of the switchlight comes on to indicate an uplock unsafe condition, and the PRESS portion comes on to indicate when the RAT is operating (producing pressure). The switchlight guard is safety wired closed and has a placard: WARNING - PULL CB1 B14 BEFORE RELAMPING. Failure to observe this warning can cause inadvertent RAT deployment.

Ground maintenance control capability is provided at the HYDRAULIC SERVICE PANEL, zone 147. A guarded momentary-type toggle switch (DEPLY/RESET) bypasses the interlock circuitry to deploy the RAT and to reset the uplock for stowing. A mechanical safety bar device with safety streamer is used to



1 WING CENTER SECTION BOX BEAM
2 RAM AIR TURBINE DEPLOYMENT ACTUATOR
3 HYDRAULIC SERVICE PANEL, ZONE 147
4 RAM AIR TURBINE TRUNNION
5 RAM AIR TURBINE UPLOCK
6 UPLOCK ACTUATOR HOOK
7 STRUCTURE HARD POINT (RAT HOISTING)
8 RAM AIR TURBINE CONTROL MODULE
9 DOOR ACTUATING RODS (2)
10 UPLOCK LUG
11 RAT STOWING SLING ATTACH POINTS (2)
12 RAM AIR TURBINE - DRIVEN HYDRAULIC PUMP
13 RAM AIR TURBINE PROPELLER (2 BLADES)
14 RAM AIR TURBINE HUB
15 RAM AIR TURBINE DOORS (2)
16 PROXIMITY TARGET
17 PROXIMITY SENSOR

Ram Air Turbine System
Figure 1

lock the RAT in the stowed position to protect ground personnel from inadvertent deployment. The safety bar is stowed in the hydraulic service center.

Ground maintenance checkout is accomplished by connecting a ground test box to a test plug which operates a solenoid valve to port hydraulic system pressure to the RAT pump. The pump now acts as a motor to check the turbine speed governor. The pump momentarily develops pressure on spindown with indication at the test box.

3. Ram Air Turbine

A. Description and Operation

The RAT consists of a turbine and a variable displacement hydraulic pump mounted on a trunnion pivoted support leg (Ref. Fig. 3). The RAT is deployed from a fuselage stowed position into the airstream upon signal to generate emergency hydraulic power. Two doors, hinged at the sides of the RAT deployment opening, are mechanically operated by rods attached to the RAT support leg. The door actuator rods are adjustable to obtain surface contour flushness when the RAT is locked in the stowed position.

The turbine is a 27-inch diameter, two-bladed propeller on a 6-inch diameter hub. Turbine blade angle is varied by a closed-loop hydraulic system in the leg and controlled by a centrifugal governor in the hub. A pulse generator, also within the hub, verifies speed on ground checkout. A spring-loaded pin in the leg locks the blades in position upon stowing and mechanically unlocks (retracts) during deployment when the blades have sufficient clearance for rotation. An additional spring-loaded pin at the trunnion end locks the leg in the deployed position and must be manually unlocked to stow the RAT. The pivot contains internal swivel glands and provides passage for hydraulic fluid flow to and from the hydraulic pump.

The pump is a variable-delivery, constant-pressure, piston type driven at 5200 rpm and capable of providing 15 gpm at 3000 psi to hydraulic system B. Case drain flow is returned to the pump inlet line through a filter.

4. Ram Air Turbine Deployment Actuator

A. Description and Operation

R The RAT actuator is a dual-spring powered piston/cylinder.
R The RAT is deployed into the airstream and attains full

R speed within 3 seconds to provide emergency hydraulic power
R for flight control. The actuator is filled with oil through
R a charging valve on the upper end of the cylinder. An
R internal piston and cylinder forces oil through progressive
R metering orifices to absorb the shock of entry into the
R airstream (Ref. Fig. 4).

The RAT is retracted into the stowed position, on the ground, by use of a portable (fishpole) hoist to overcome the 750-pound spring force of the deployment actuator.

5. Ram Air Turbine Uplock

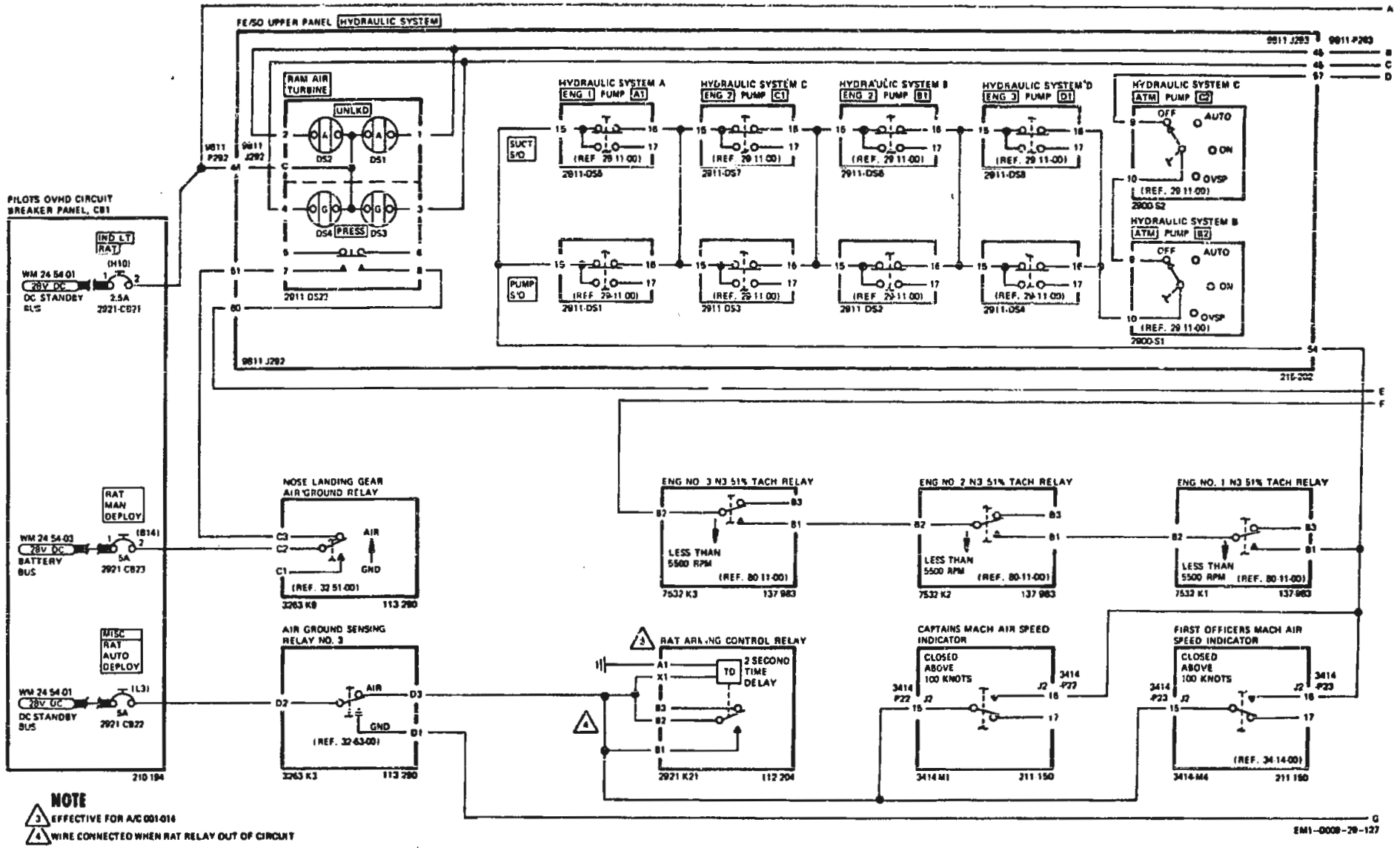
A. Description and Operation

R The RAT uplock, a 28V dc motor-operated mechanism, locks the
R RAT in the stowed position against the actuator spring
R force. The motor-operated uplock is energized by the auto
R deployment circuit. The redundant squib actuator is
R mechanically linked to the uplock mechanism, will release
R the RAT when fired by manual operation of the RAM AIR
R TURBINE switchlight on the Flight Engineer/Second Officers
R HYDRAULIC SYSTEM panel, zone 215 (Ref. Fig. 5).

A manual release hex shaft extends through the mounting structure. It enables the uplock to be unlocked during ground maintenance operations in the event the uplock actuator motor is inoperative or electrical power cannot be applied to the system.

An automatic reset circuit drives the uplock fully locked each time full power is applied to No. 2 engine on the ground. The circuit directs power through the ground-air sensing relay No. 3 and the engine out armed light relay to the reset side of the RAT control switch in the hydraulic service center and to the reset winding of the uplock actuator. The squib actuator (trigger assembly), mounted on top of the uplock assembly, contains an explosive charge which is completely contained within the unit when discharged normally or accidently. The one moving part, the ram, extends from the flange end 0.40 inches with a force of 25 pounds.

NOTE: The automatic reset circuit may also be energized by placing the flap lever in a takeoff position and by depressing and holding number 2 engine N2 BITE switch on the Flight Engineer/Second Officer ENGINE STATUS panel until ENGINE 2 FAIL-ARMED light on the pilots CAUTION AND WARNING panel is on. If the circuit is functionally correct the ENGAGE light on the GROUND



NOTE

3 EFFECTIVE FOR A/C 001-016

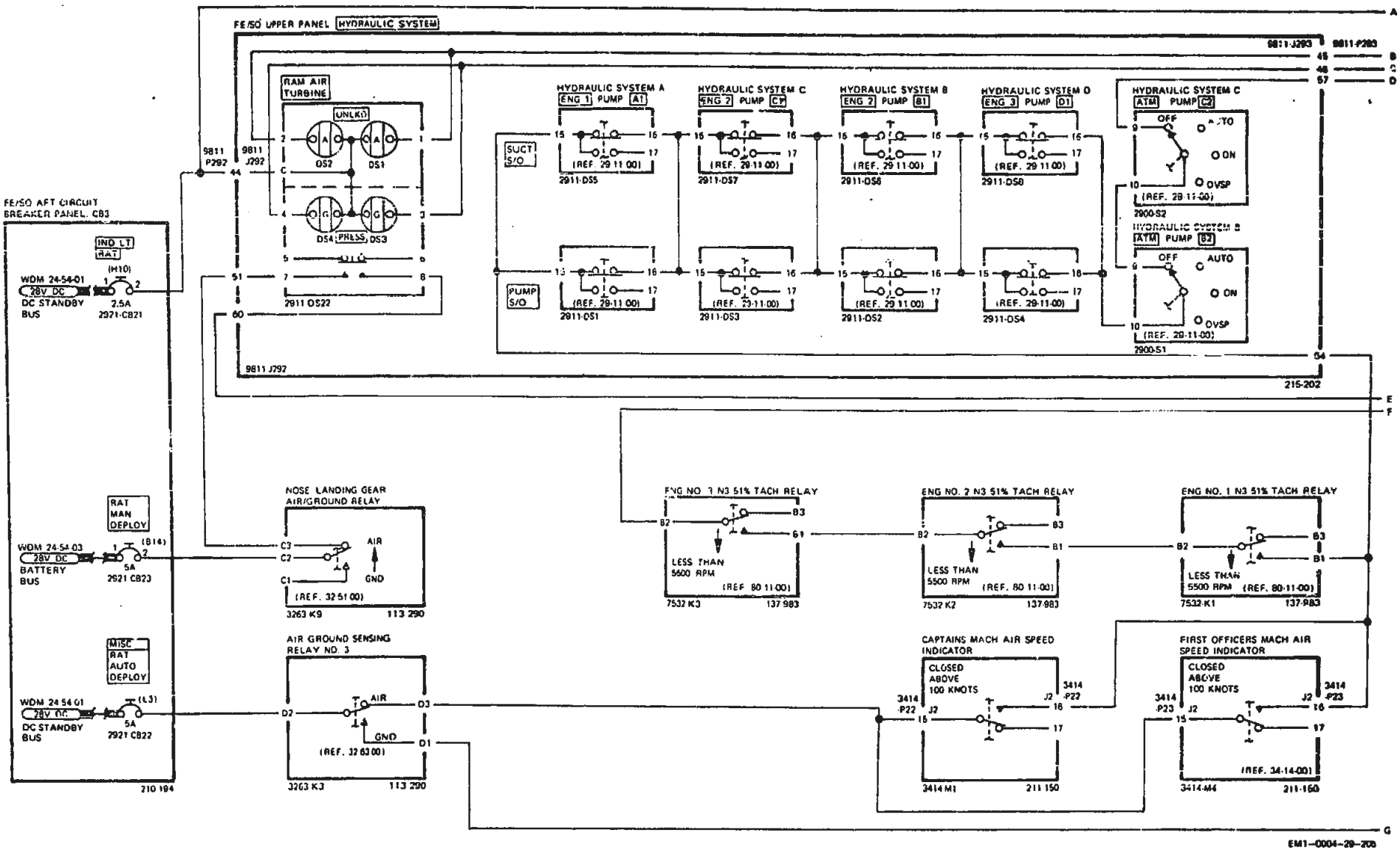
4 WIRE CONNECTED WHEN RAT RELAY OUT OF CIRCUIT

CR
LR

Ram Air Turbine Electrical Schematic
Figure 2 (Sheet 1)

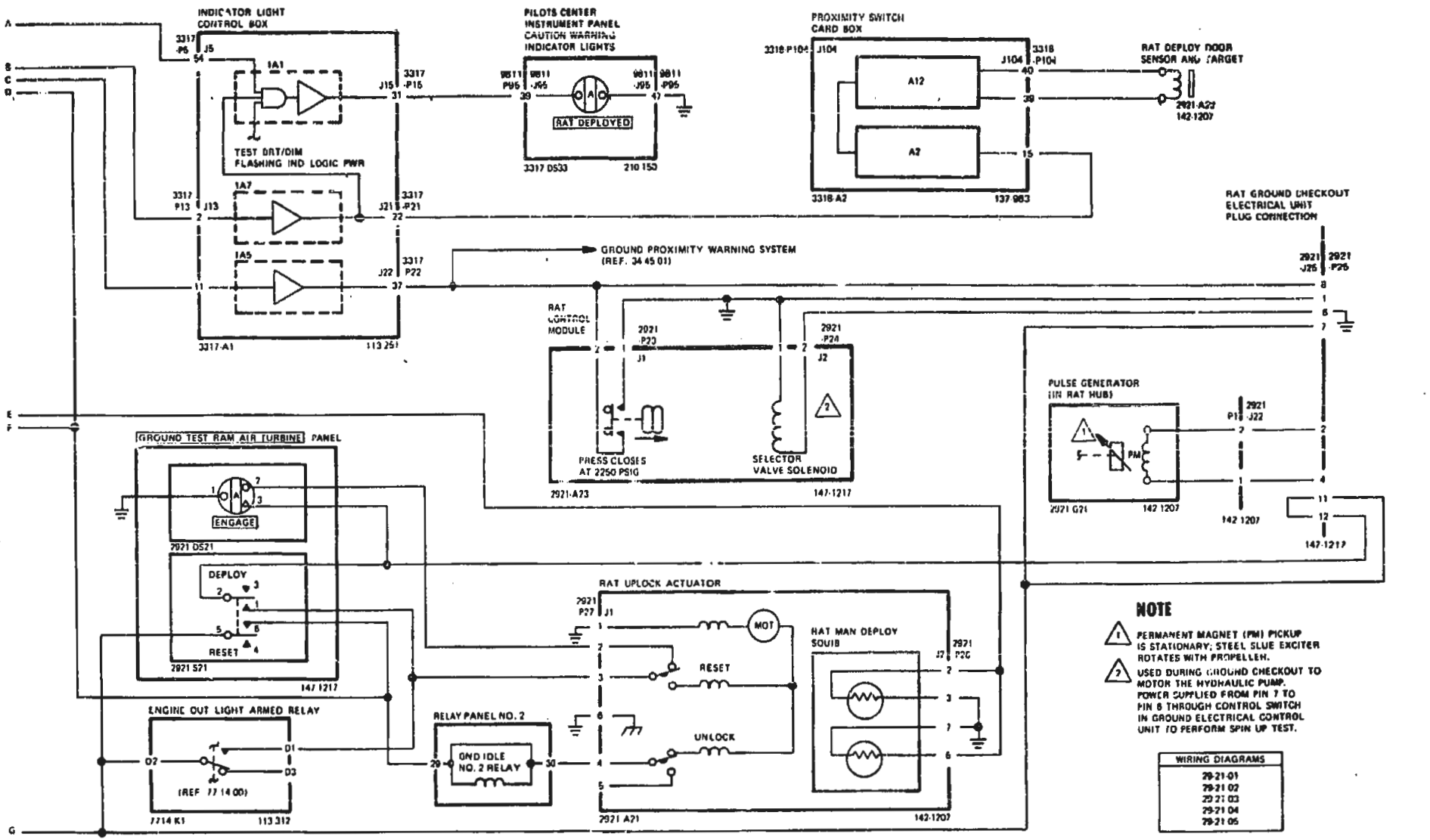
EFFECTIVITY: 001-031

001B



Ram Air Turbine Electrical Schematic
Figure 2 (Sheet 1)

EFFECTIVITY: 032-999



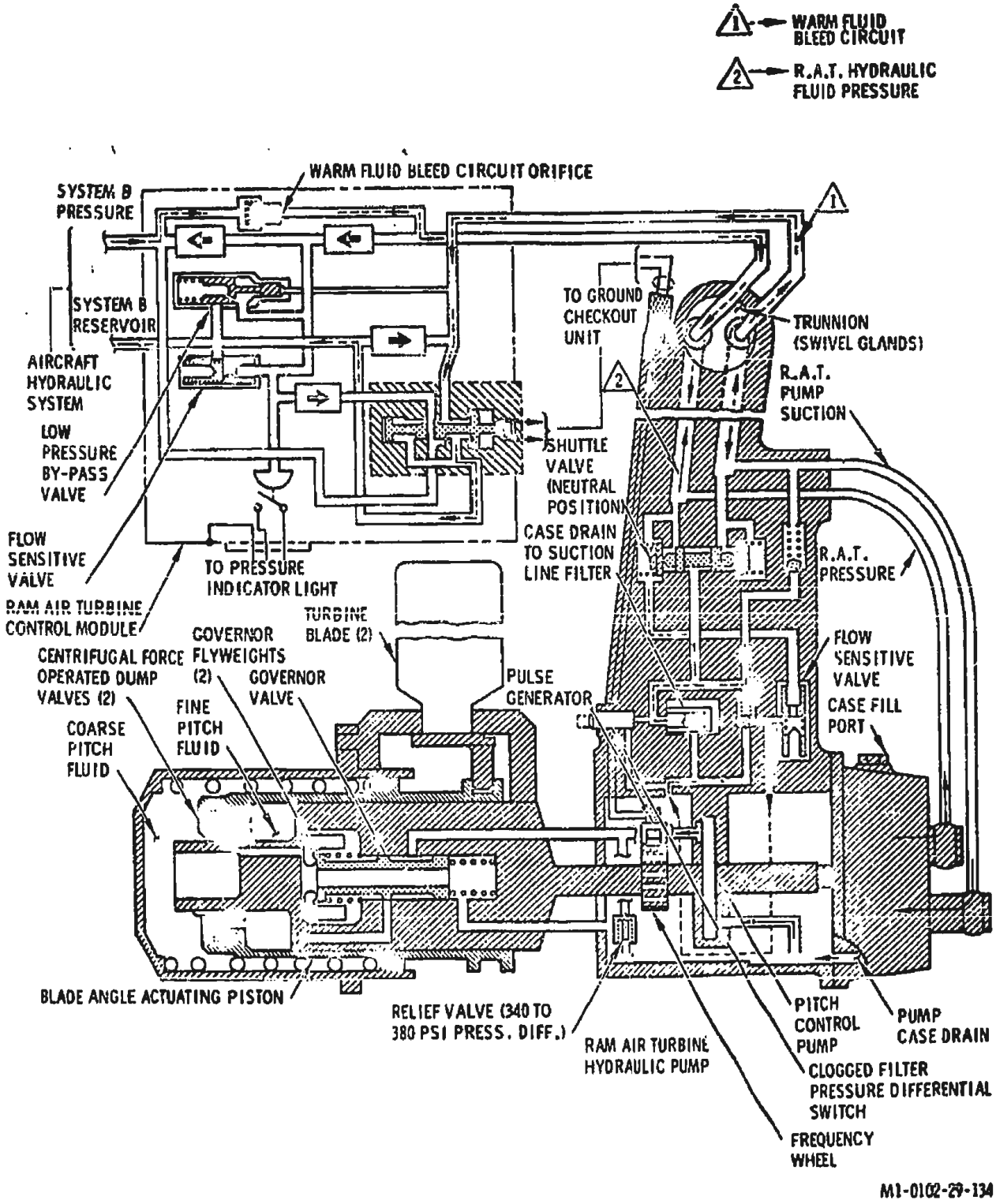
NOTE

1. PERMANENT MAGNET (PM) PICKUP IS STATIONARY; STEEL SLUE EXCITER ROTATES WITH PROPELLER.
2. USED DURING GROUND CHECKOUT TO MOTOR THE HYDRAULIC PUMP. POWER SUPPLIED FROM PIN 7 TO PIN 8 THROUGH CONTROL SWITCH IN GROUND ELECTRICAL CONTROL UNIT TO PERFORM SPIN UP TEST.

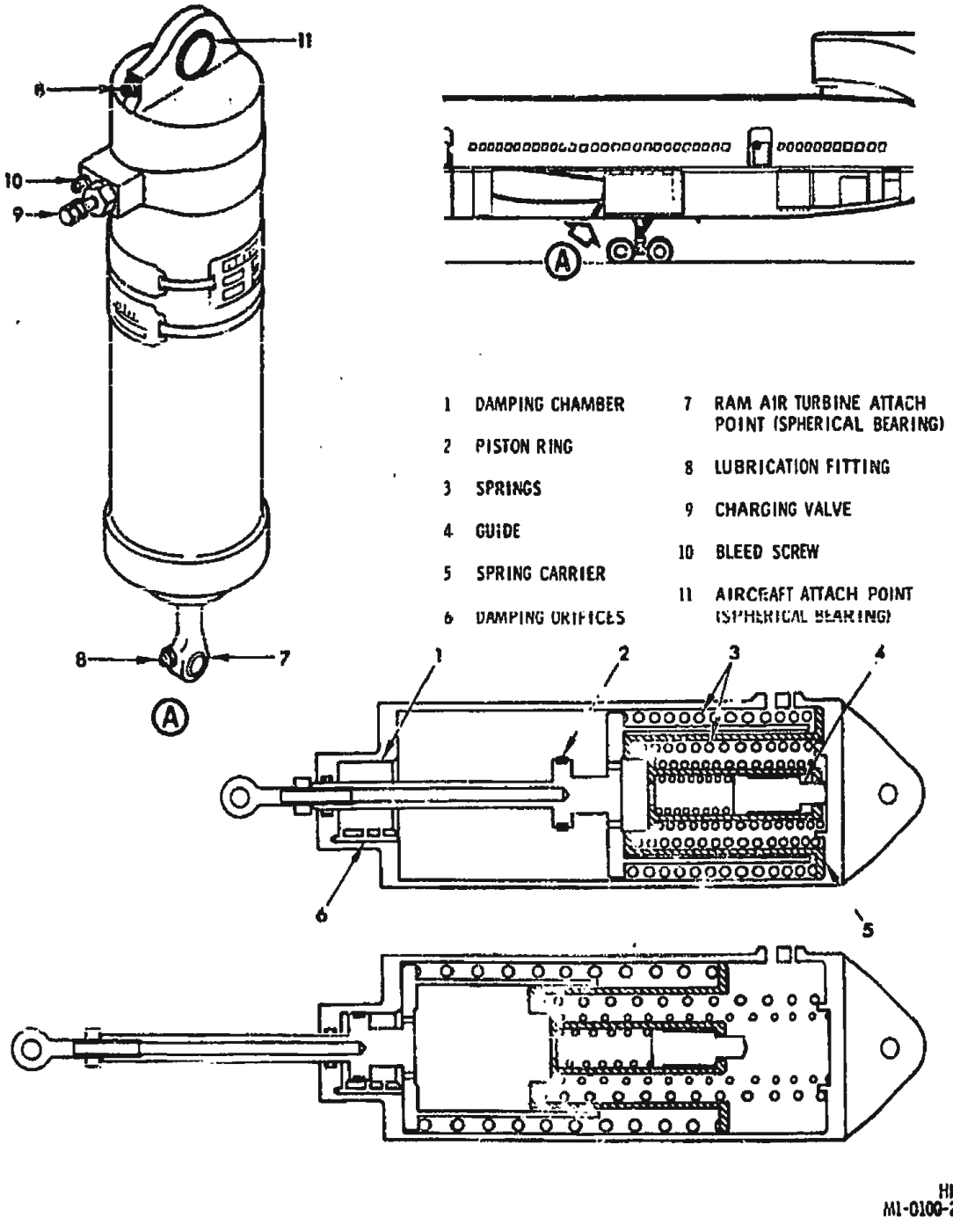
WIRING DIAGRAMS
29-21-01
29-21-02
29-21-03
29-21-04
29-21-05

EM1-0000-29-399

Ram Air Turbine Electrical Schematic
Figure 2 (Sheet 2)



Ram Air Turbine Functional Schematic
Figure 3



Ram Air Turbine Deployment Actuator
Figure 4

TEST RAM AIR TURBINE panel in the hydraulic service center will be on.

The squib actuator is an explosive device which requires special handling. Precautions must be taken to disconnect the electrical connector before beginning any maintenance operations.

The RAT cannot be restowed after a squib actuator has been fired until the squib actuator assembly has been replaced. The extended ram prevents the uplock from resetting.

The position indicator button mounted on top of the uplock, when depressed, will detect a locked or unlocked hook condition within the unit. If the button can be fully depressed, the uplock hook mechanism is in a fully locked position; if the button will not bottom out, it is not fully locked.

6. Ram Air Turbine Control Module

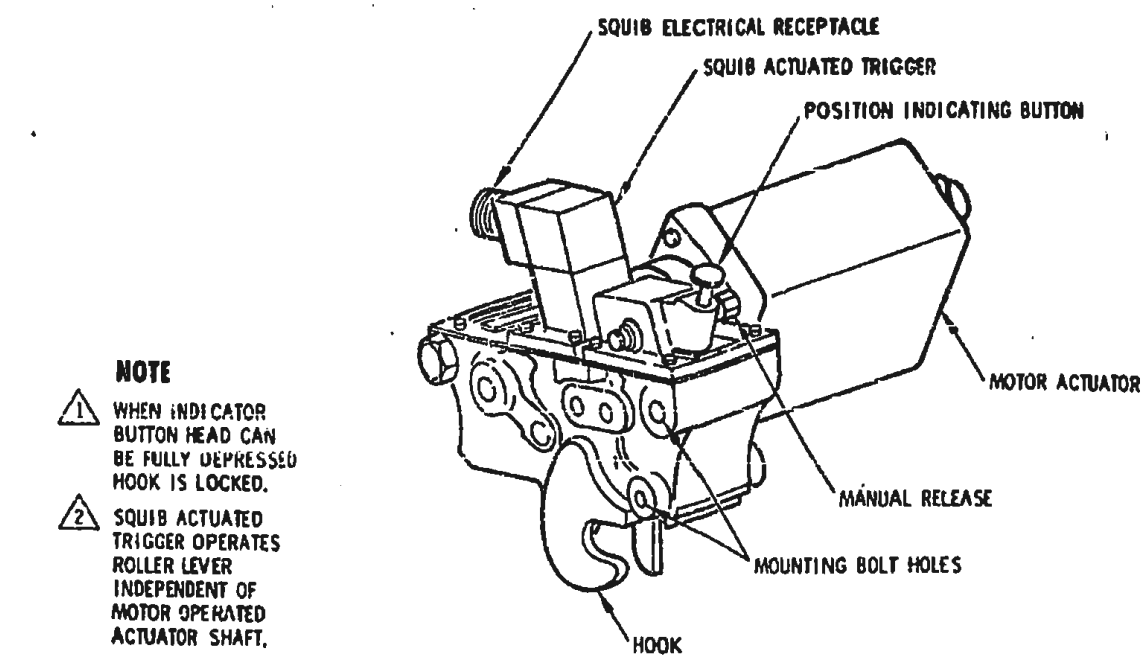
A. Description and Operation

The ram air turbine control module consists of check valves, a flow-sensitive valve, a solenoid-operated selector valve, a low pressure bypass valve and a pressure switch (Ref. Fig. 6). Fluid under reservoir pressure is directed to the turbine-driven hydraulic pump through the control module. The pump outlet fluid is directed back into the inlet through the flow-sensitive valve until the turbine attains 60 percent of full speed (sufficient to prevent turbine stall). The flow is then directed into hydraulic system B. A warm bleed circuit is incorporated in the turbine internal hydraulic system. A screened orifice in the control module meters a flow of system B fluid into the ram air turbine-driven hydraulic pump line. The fluid flows through the turbine control valves and pump case to keep the turbine govenor system warm enough to function instantly upon deployment. The low pressure bypass valve enables the turbine to attain governing speed during ground spin-up operational check.

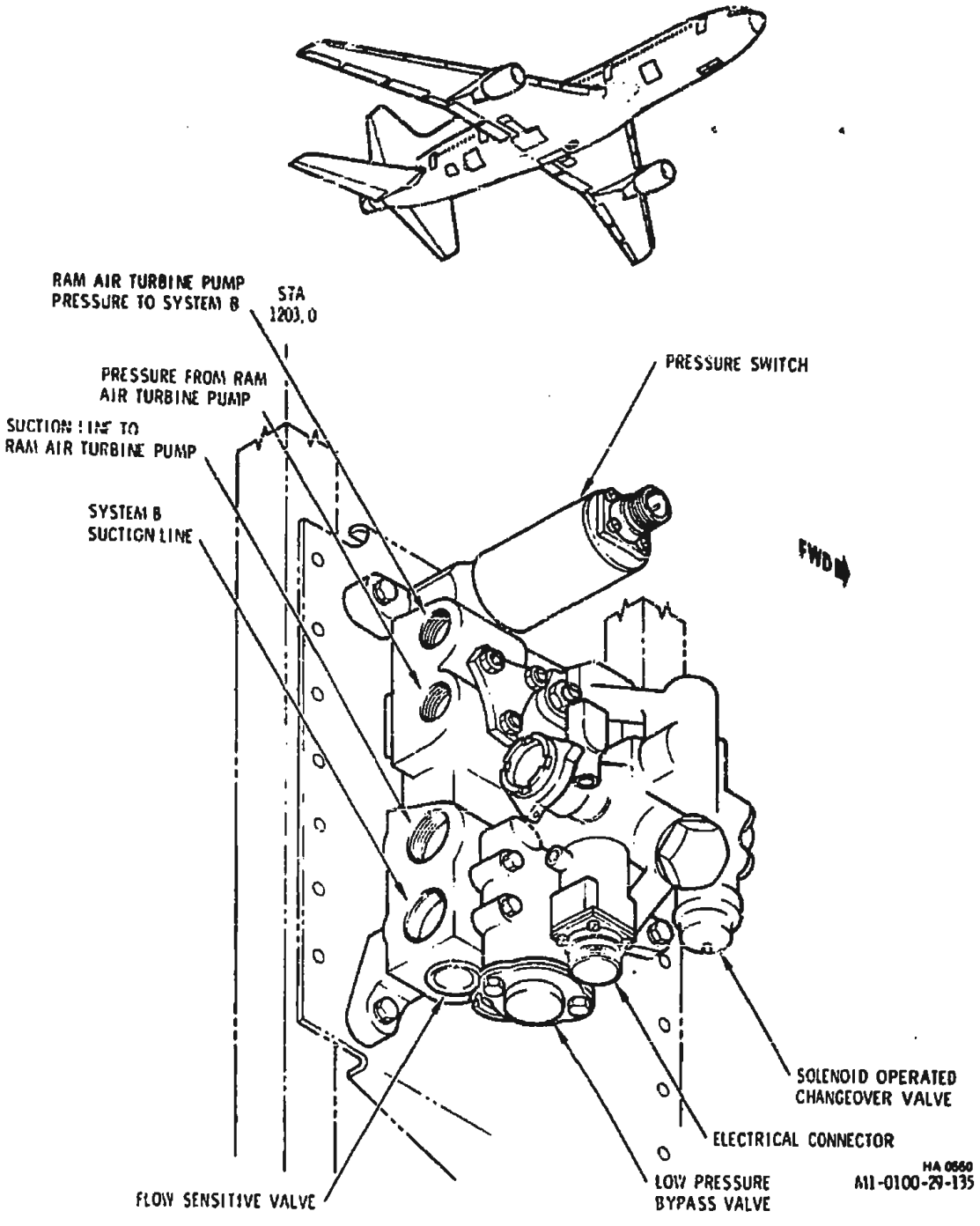
7. Ram Air Turbine System Pressurization

A. Description and Operation

An auxiliary reservoir pressurization system is incorporated into all four hydraulic systems. The system consists of a priority valve in the reservoir pressurization part of the high-pressure filter modules and a 75-cubic inch accumulator



Ram Air Turbine Uplock
Figure 5

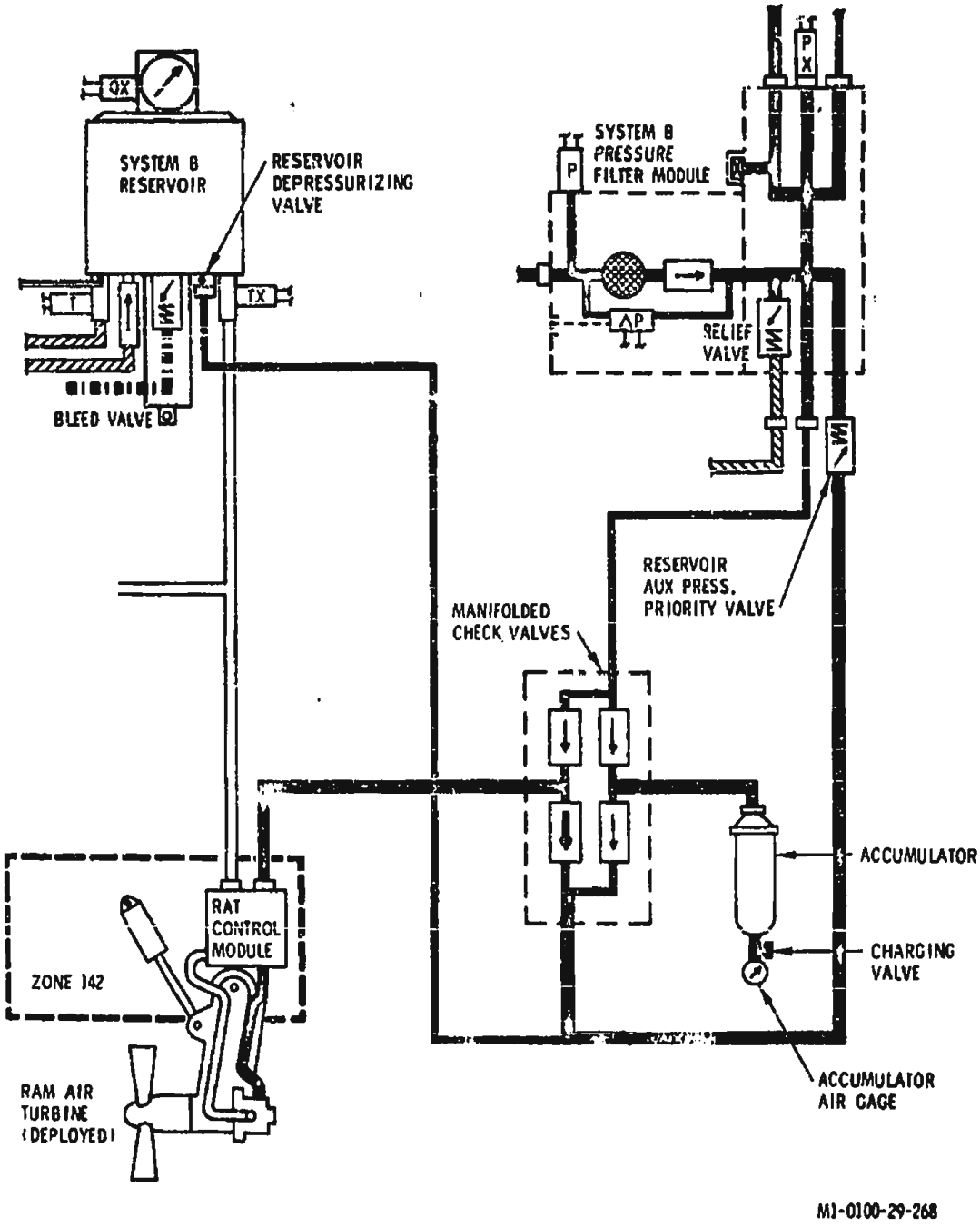


Ram Air Turbine Control Module
Figure 6

in each pressurization line (Ref. 29-13-00). The accumulators are mounted on the hydraulic service center sidewalls at the forward end near the brake accumulators.

In system B, a manifold check valve module containing four check valves provides a warm oil bleed circuit for the RAT and ensures reservoir pressure for the RAT upon deployment. The priority valve for system B is larger than those in the other systems because the RAT output is directed into the hydraulic system through the priority valve (Ref. Fig. 7).

The addition of the reservoir auxiliary pressurization accumulator makes it necessary to bleed off the system return pressure, (approximately 55 psi) before opening any hydraulic lines. This is accomplished by operating the depressurization valve at the base of the applicable reservoir until the SYS RESERVOIR pressure gage on the HYDRAULIC SERVICE PANEL indicates zero psi.



Ram Air Turbine System Pressurization Schematic
Figure 7

R # RAM AIR TURBINE SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

R If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 29 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in this section.

R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Ram Air Turbine Operation
SCHEM 1	Ram Air Turbine Electrical Schematic

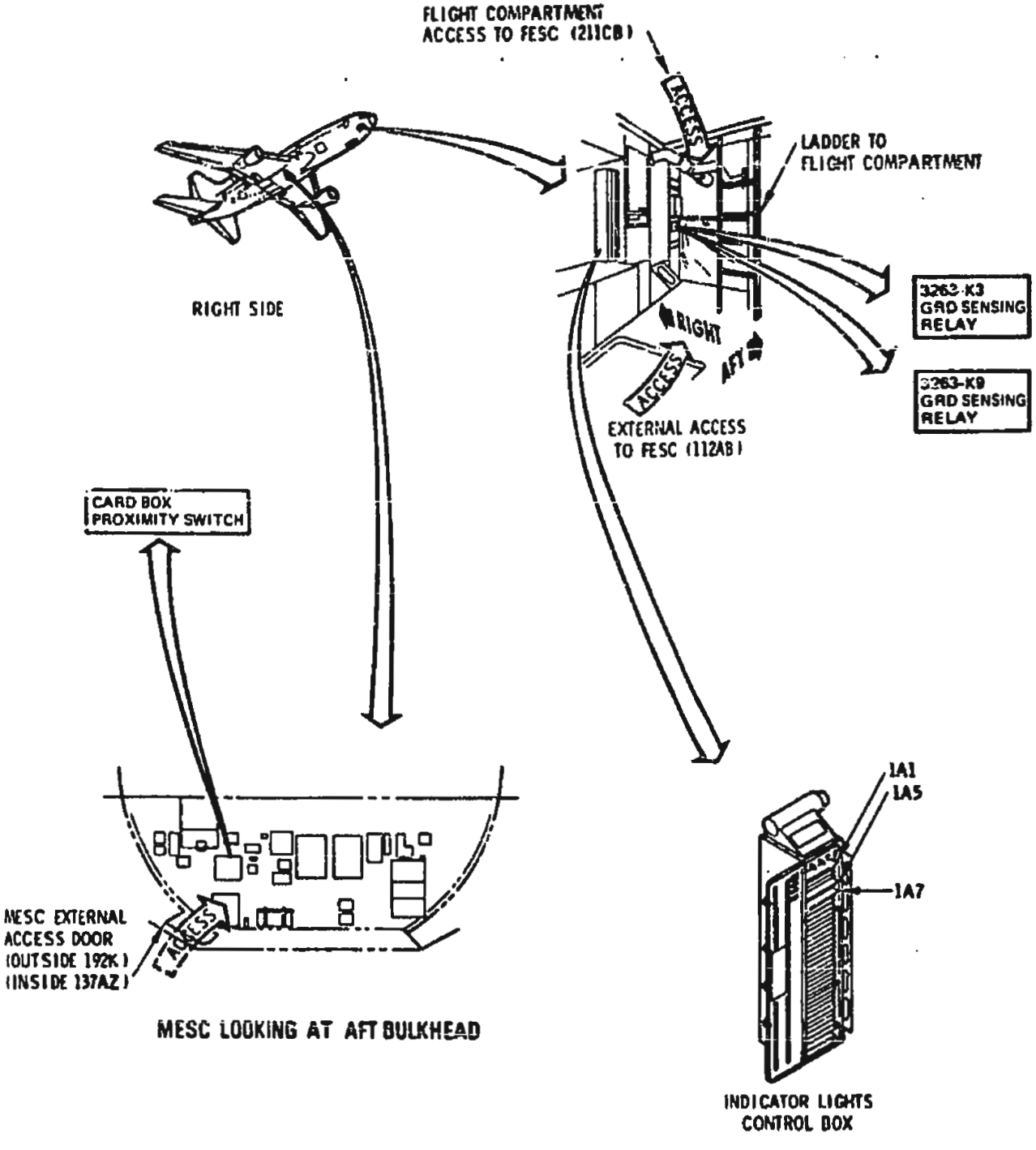
COMPONENT	QTY	AREA/ACCESS	REFERENCE
CIRCUIT BREAKERS:			
IND LT RAT 2921-CB21	1	FLT STA/CB3 G10	*
IND LT RAT 2921-CB21	1	FLT STA/CB3 H10	*
RAT AUTO DEPLOY 2921-CB23	1	FLT STA/CB1 B14	*
RAT MAN DEPLOY 2921-CB22	1	FLT STA/CB1 L3	*
CONTROL BOX - INDICATOR LIGHT ILCB	1	MESC/112AB	31-22-00
CONTROL MODULE - RAM AIR TURBINE	1	RAT COMPARTMENT	29-21-13
LIGHT - RAT DEPLOY ANNUNCIATOR	1	FLT STA/CTR INSTR PNL	20-33-02
PANEL - FE/SO HYDRAULIC	1	FLT STA ZONE 215	29-11-00
RAM AIR TURBINE	1	RAT COMPARTMENT	29-21-00

*SEE WM EQUIPMENT LIST

M1-0000-29-834

R
R

Component Location Index
Figure 101

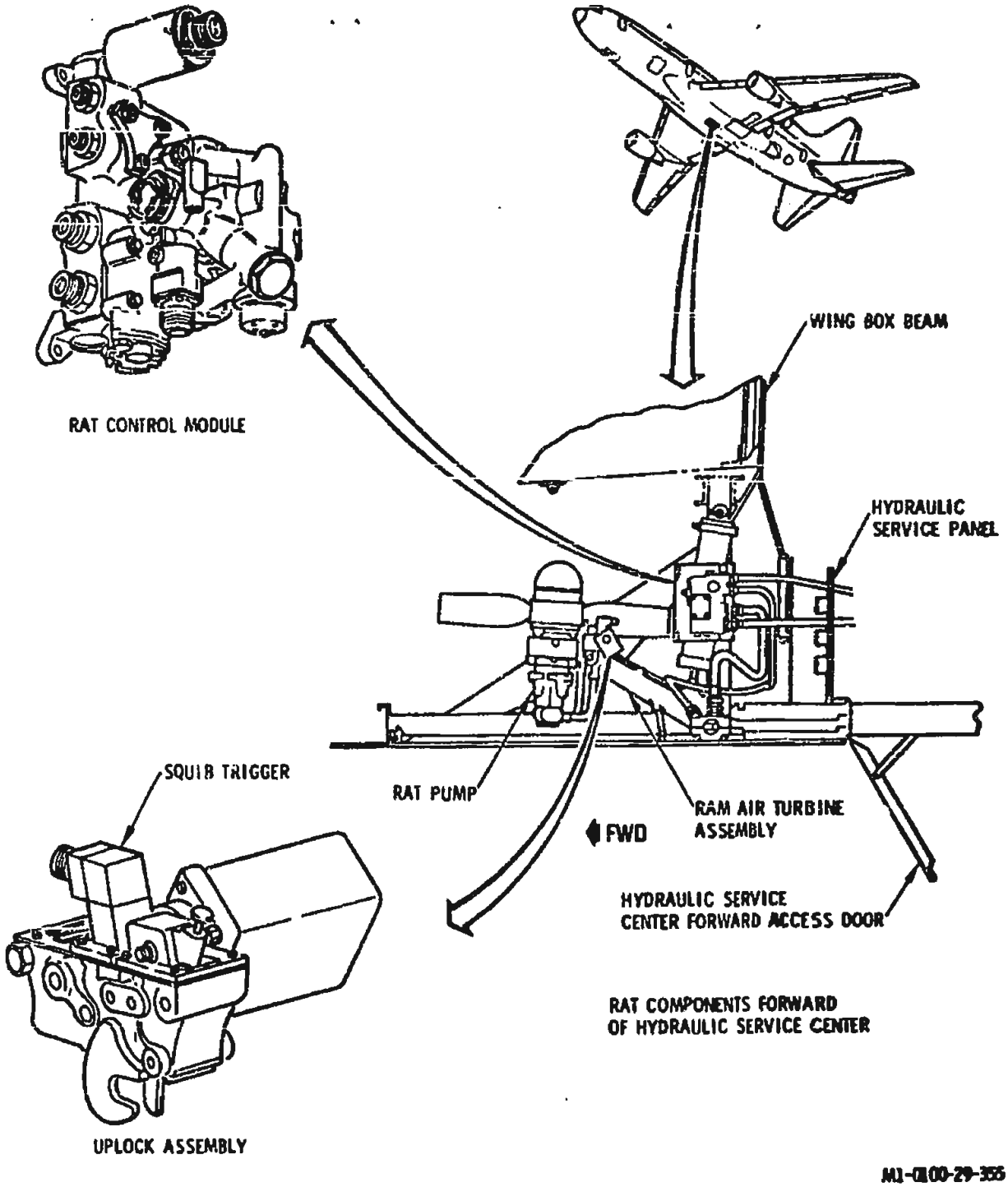


M1-0100-29-354

R R Ram Air Turbine System Component Locator
Figure 102 (Sheet 1)

R R EFFECTIVITY: ALL

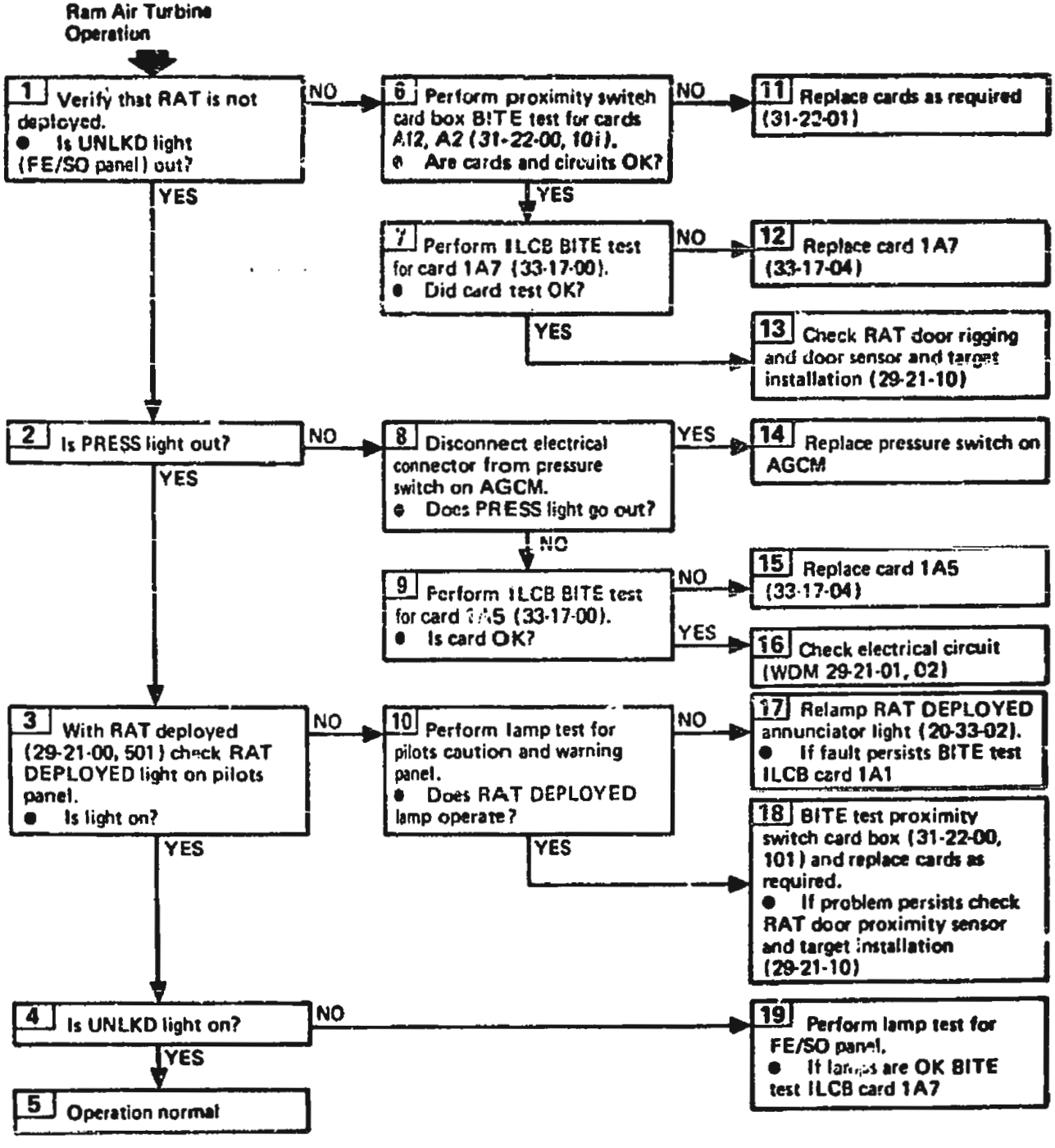
001B



RAT COMPONENTS FORWARD OF HYDRAULIC SERVICE CENTER

R R Ram Air Turbine System Component Locator
Figure 102 (Sheet 2)

R R 001B EFFECTIVITY: ALL


Ram Air Turbine Operation
1 Verify that RAT is not deployed.
● Is UNLKD light (FE/SO panel) out?
NO
6 Perform proximity switch card box BITE test for cards A12, A2 (31-22-00, 101).
● Are cards and circuits OK?
NO
11 Replace cards as required (31-22-01)
YES
7 Perform ILCB BITE test for card 1A7 (33-17-00).
● Did card test OK?
NO
12 Replace card 1A7 (33-17-04)
YES
13 Check RAT door rigging and door sensor and target installation (29-21-10)
YES
2 Is PRESS light out?
NO
8 Disconnect electrical connector from pressure switch on AGCM.
● Does PRESS light go out?
YES
14 Replace pressure switch on AGCM
YES
NO
9 Perform ILCB BITE test for card 1A5 (33-17-00).
● Is card OK?
NO
15 Replace card 1A5 (33-17-04)
YES
16 Check electrical circuit (WDM 29-21-01, 02)
3 With RAT deployed (29-21-00, 501) check RAT DEPLOYED light on pilots panel.
● Is light on?
NO
10 Perform lamp test for pilots caution and warning panel.
● Does RAT DEPLOYED lamp operate?
NO
17 Relamp RAT DEPLOYED annunciator light (20-33-02).
● If fault persists BITE test ILCB card 1A1
YES
YES
18 BITE test proximity switch card box (31-22-00, 101) and replace cards as required.
● If problem persists check RAT door proximity sensor and target installation (29-21-10)
4 Is UNLKD light on?
NO
19 Perform lamp test for FE/SO panel.
● If lamps are OK BITE test ILCB card 1A7
YES
5 Operation normal

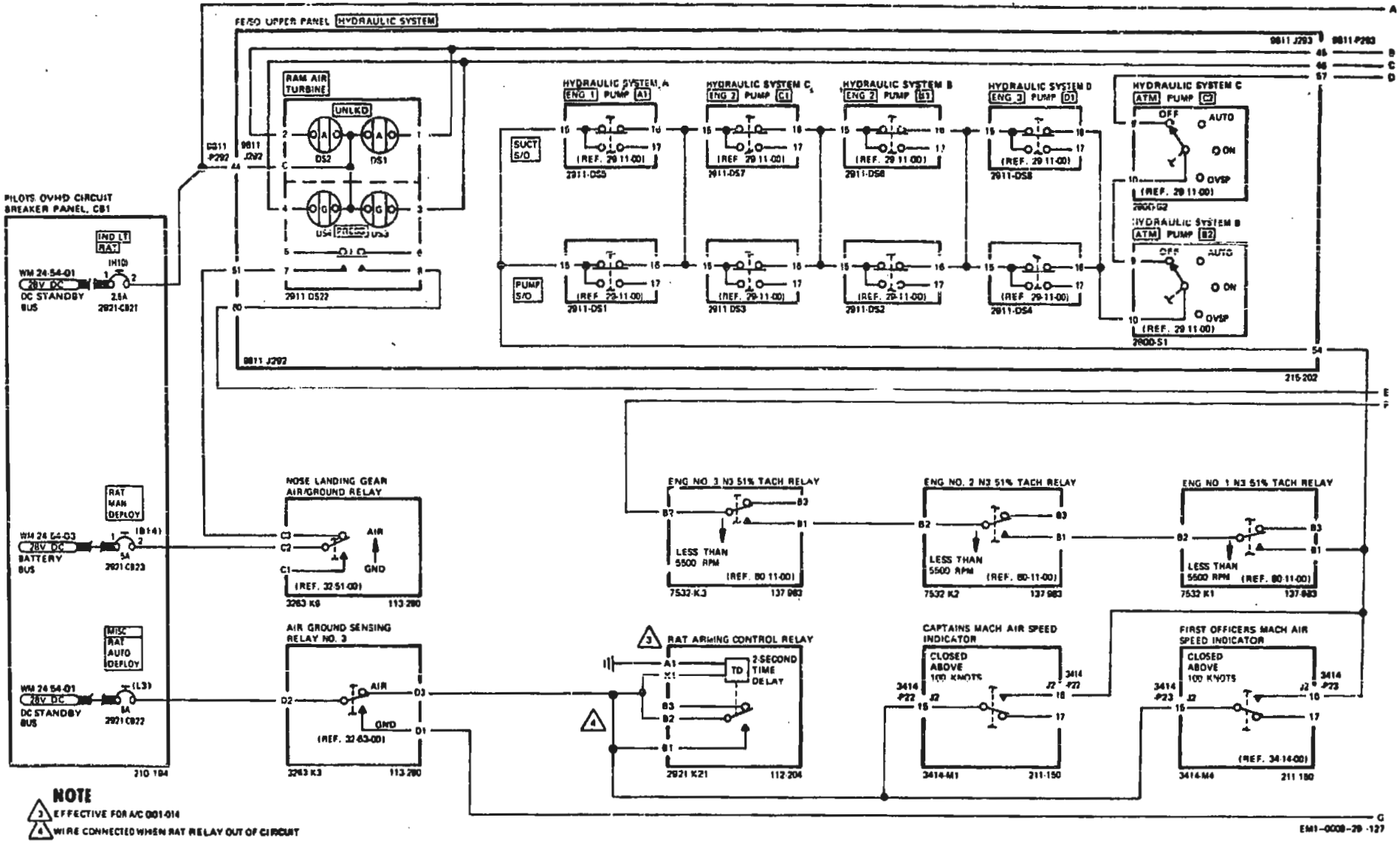
PREREQUISITES
CB's: CB1-B14, L3; CB3-G10

M1-0100-29-338

R Ram Air Turbine Operation
R Figure 103

EFFECTIVITY: ALL

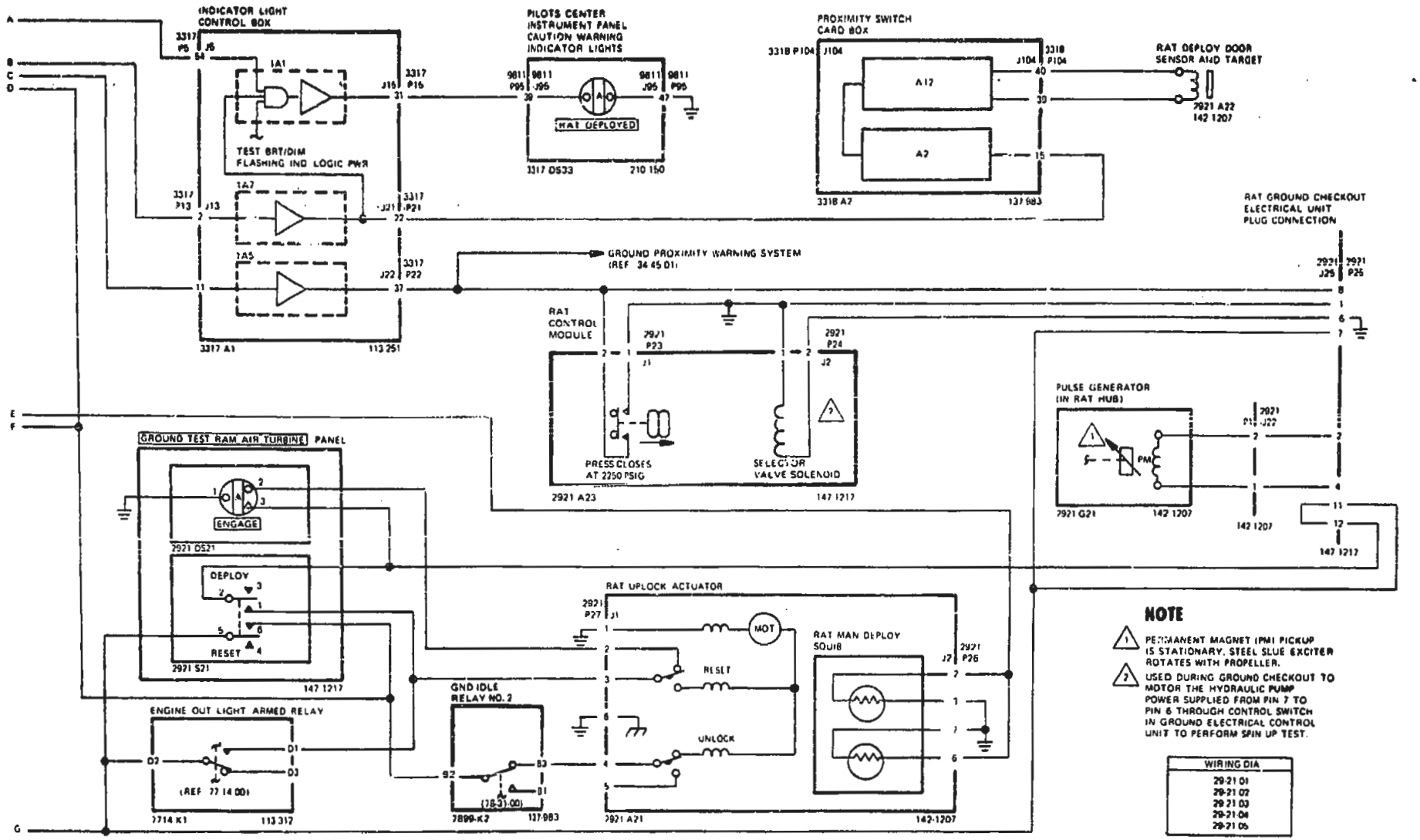
001B



CR Ram Air Turbine Electrical Schematic
CR SCHEM 1 (Sheet 1)

EFFECTIVITY: 001-031

001B



NOTE

1. PERMANENT MAGNET (PMI PICKUP IS STATIONARY, STEEL SLUE EXCITER ROTATES WITH PROPELLER.
2. USED DURING GROUND CHECKOUT TO MOTOR THE HYDRAULIC PUMP POWER SUPPLIED FROM PIN 7 TO PIN 6 THROUGH CONTROL SWITCH IN GROUND ELECTRICAL CONTROL UNIT TO PERFORM SPIN UP TEST.

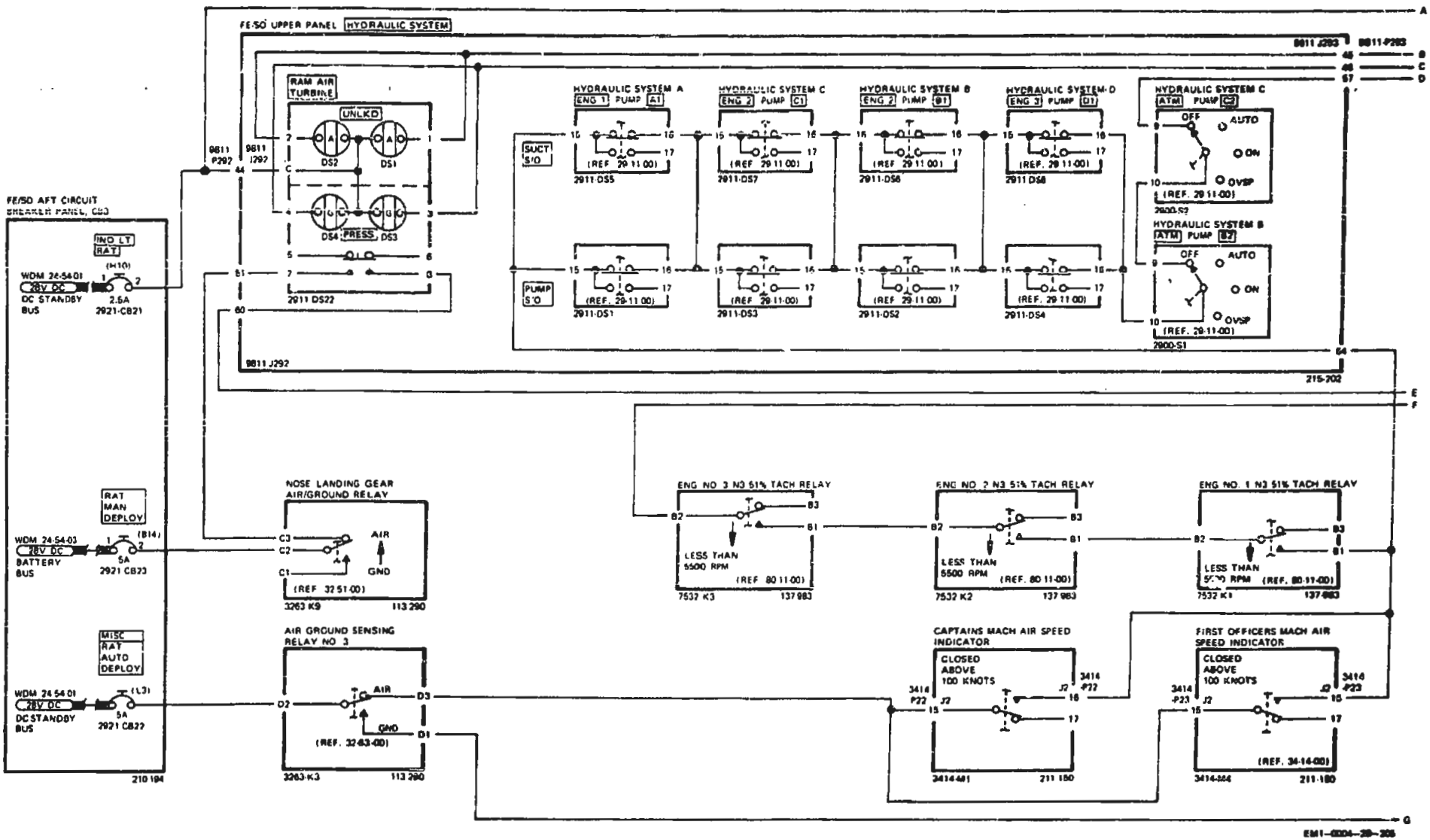
WIRING DIA
29-21 01
29-21 02
29-21 03
29-21 04
29-21 05

EM1-0001-29-300

CR Ram Air Turbine Electrical Schematic
CR SCHEM 1 (Sheet 2)

EFFECTIVITY: 001-031

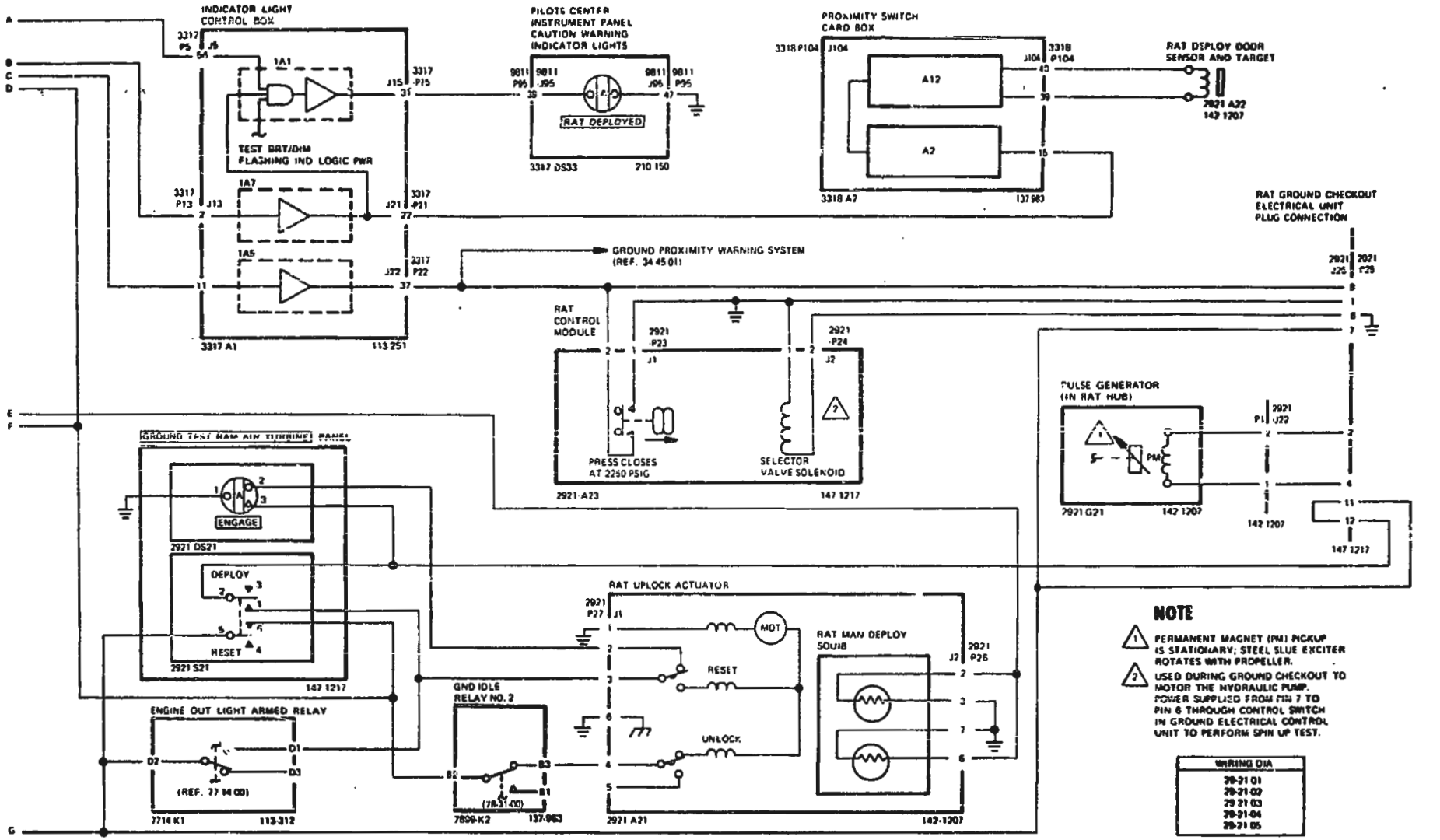
001B



CR Ram Air Turbine Electrical Schematic
CR SCHEM 1 (Sheet 1)

EFFECTIVITY: 032-999

001B



NOTE

1. PERMANENT MAGNET (PM) PICKUP IS STATIONARY; STEEL SLUE EXCITER ROTATES WITH PROPELLER.
2. USED DURING GROUND CHECKOUT TO MOTOR THE HYDRAULIC PUMP. POWER SUPPLIED FROM PIN 7 TO PIN 6 THROUGH CONTROL SWITCH IN GROUND ELECTRICAL CONTROL UNIT TO PERFORM SPIN UP TEST.

WIRING DIA
29-21 01
29-21 02
29-21 03
29-21 04
29-21 05

EM1-0001-29-380

CR Ram Air Turbine Electrical Schematic
CR SCHEM 1 (Sheet 2)

EFFECTIVITY: 032-999

001B

RAM AIR TURBINE SYSTEM - MAINTENANCE PRACTICES

1. General

Ram air turbine (RAT) deployment is explosively fast and could occur inadvertently under certain aircraft conditions during maintenance procedures (Ref. 29-21-00). The ram air turbine ground safety lock should be installed whenever personnel are working near the hydraulic service center area.

The safety lock is an aircraft loose equipment item stowed in the hydraulic service center forward access door entry (Ref. Fig. 201).

2. Equipment and Materials

Ram Air Turbine Ground Safety Lock, PN 1304565

3. Maintenance Practices

A. Ground Safety Lock Installation

(1) On pilots overhead circuit breaker panel CB1, verify that RAT AUTO DEPLOY (L3) and RAT MAN DEPLOY (B14) circuit breakers are opened and tagged.

(2) Open hydraulic service center forward access door, 147AB.

(3) Remove safety lock bar from stowed position on floor beam above door hinge by depressing stowage pin release button and pulling out pin.

R R CAUTION: DO NOT STAND DIRECTLY UNDER RAM AIR TURBINE DOOR AREA WHEN INSTALLING SAFETY LOCK.

(4) Place safety lock bar across RAT doors approximately six inches forward of aft end and engage captive wing screws into plate nut holes.

(5) Tighten wing screws finger-tight.

B. Ground Safety Lock Removal and Stowage

WARNING: DO NOT STAND DIRECTLY UNDER RAM AIR TURBINE DOOR AREA WHEN REMOVING SAFETY LOCK.

IF WING SCREWS TURN HARD OR IF DOORS MOVE WITH SAFETY LOCK, VERIFY THAT RAT IS IN FULL UPLOCK CONDITION BEFORE REMOVING SAFETY LOCK.(UPLOCK POSITION INDICATOR BUTTON SHOULD BOTTOM).

R (1) Remove RAT ground safety lock bar as follows:

(a) Close Hydraulic Service Center forward access door.

(b) Stand between left and right MLG doors facing forward.

R (c) While removing bar remain aft and clear of traverse of fully deployed RAT.

(d) Loosen wing screws, observing WARNING above.

NOTE: Backing out both wing screws simultaneously (to avoid binding) will allow up to 0.60 inch below contour to determine if RAT unlatch exists.

(e) If door movement indicates an unlatch condition, reseat safety bar and restow RAT mechanism (29-21-10).

(f) If no door movement is evident, complete removal of safety lock bar.

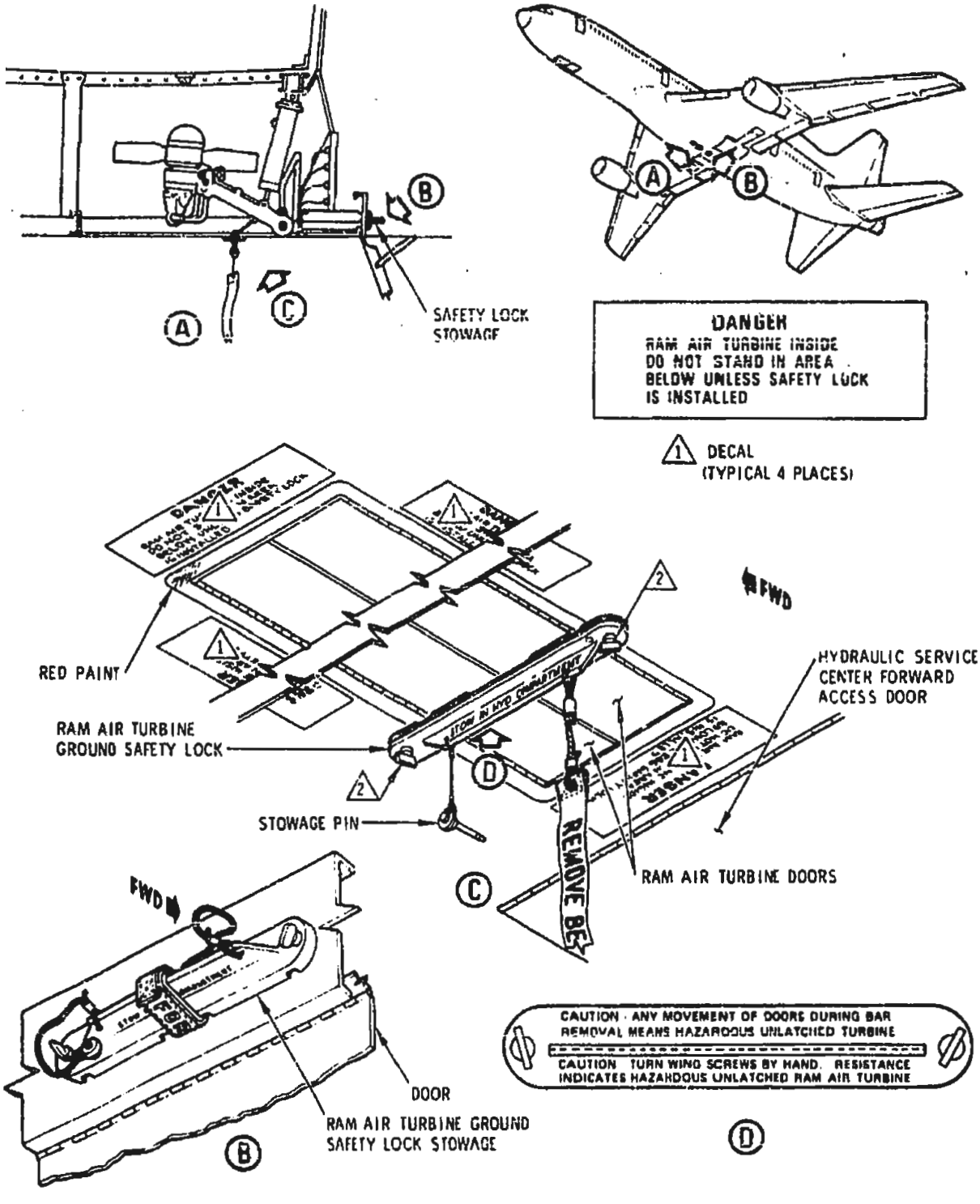
(2) Stow safety lock bar in hydraulic service center forward door entry as follows:

(a) Wrap streamer around safety bar and place in position on floor beam with wing screws in holes and stowage pin holes aligned.

(b) Depress stowage pin button and insert through safety lock bar and floor beam. Release button.

(3) Close and lock hydraulic service center door.

(4) Close circuit breakers opened in Step 3A (1).



M1-0102-29-191

R Ram Air Turbine Ground Safety Lock
R Figure 201

RAM AIR TURBINE SYSTEM - ADJUSTMENT AND TEST

1. General

The squib actuator circuit test (Para. 4A) verifies the ram air turbine manual deployment control circuit from the Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215.

The deployment test (Para. 4B) verifies deployment from ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, zone 147.

The spin-up test (Para. 4C) is accomplished using a ground checkout electrical unit to verify ram air turbine control and hydraulic pump operation.

R The auto-deploy circuit test (Para. 4D) verifies the auto-deploy circuit to the RAT uplock actuator.

R The auto reset circuit test (Para. 4E) verifies the circuit that provides momentary power to the reset winding of the ram air turbine uplock actuator during takeoff.

2. Equipment and Materials

Ground Checkout Electrical Unit, GCEU1-2

RAT Stowing Sling, BF84, or equivalent

Aircraft Components Portable Hoist, WE3981, or equivalent

Electrical Meter, Simpson 260, or equivalent

Flight Line Test Actuator and Deactuator Targets Set, EDC Model 8-005101-01, or equivalent

Test jumper plug P/N A-6820 or equivalent (jumper wire)

Ram Air Turbine Spin-up Test Safety Cage (local manufacture)

3. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

29-21-00 Ram Air Turbine - Maintenance Practices

29-21-10 Ram Air Turbine - Maintenance Practices

29-21-10 Ram Air Turbine - Removal and Installation

32-63-00 Air/Ground Sensing System - Adjustment and Test

4. Ram Air Turbine Operational Check

A. Squib Actuator Circuit Test

R (1) Configure circuit breakers as follows:

R (a) On pilots overhead circuit breaker panel CB1:

R Verify closed

R RAT MAN DEPLY (B14)

R LANDING GEAR - PROX SW PWR- NO. 1 (L10)

R LANDING GEAR - PROX SW PWR- NO. 4 (L11)

R (b) On Flight Engineer/Second Officers overhead
R circuit breaker panel CB2:

R Verify closed

R MLG GND SENSE (L8)

(2) Verify ram air turbine ground safety lock is installed across Ram Air Turbine (RAT) doors (Ref. 29-21-00).

(3) On the RAT uplock assembly, disconnect electrical connector from squib actuator assembly and place plastic cap over receptacle.

(4) Turn on electrical power (Ref. 24-41-00).

(5) Simulate an in-air condition at NLG proximity sensor by using appropriate target set.

(6) Establish communication between hydraulic service center and flight station (Flight Engineer/Second Officers panel, zone 215).

C (7) On Flight Engineer/Second Officers HYDRAULIC SYSTEM
C panel, lift guard on RAM AIR TURBINE momentary switch;
C depress switch.

C (8) Using a DC voltmeter, verify 28V DC between pin 2 (+) and pin 3 (gnd), and pin 6 (+) and pin 7 (gnd) of squib electrical connector (2921 P26).

(9) Establish an on-ground condition at NLG proximity sensor.

(10) Depress RAM AIR TURBINE switch again, and verify no voltage at either pin 2 or 6 of squib electrical connector.

C (11) Release switch.

(12) On RAT uplock assembly, remove plastic cap from receptacle and connect electrical connector to squib actuator assembly.

(13) Turn off electrical power if no longer required (Ref. 24-41-00).

B. Ram Air Turbine Deployment Test (Ground Test Panel)

NOTE: The ram air turbine must be initially stowed and the uplock indicator must indicate a fully locked condition. If the aircraft is on jacks, an on-ground condition must be established at MLG air/ground proximity sensors by using the appropriate target set.

R (1) On aircraft without SB76-018, configure circuit breakers as follows:

R (a) On pilots overhead circuit breaker panel CB1:

R Open and tag

R RAT MAN DEPLOY (B14)

R THRUST REVERSE ENG 2 (H17)

R Verify closed

R RAT AUTO DEPLOY (L3)

R IND LT RAT (H10)

R (1) On aircraft with SB76-018, configure circuit breakers as follows:

R (a) On pilots overhead circuit breaker panel CB1:

R Open and tag

R RAT MAN DEPLOY (B14)

R THRUST REVERSE ENG 2 (H17)

R Verify closed

R RAT AUTO DEPLOY (L3)

R IND LT RAT (H10)

R (b) On Flight Engineer/Second Officers aft circuit
R breaker panel CB3:

R Open and tag

R ENG NO. 2 GND IDLE (N8)

(2) Open hydraulic service center access door 147AB and gain access to the RAT uplock actuator (forward of HYDRAULIC SERVICE PANEL).

(3) Disconnect squib actuator electrical connector and place plastic cap on receptacle.

(4) Turn on electrical power (Ref. 24-41-00).

WARNING: RAT DEPLOYMENT OCCURS WITH EXPLOSIVE SPEED. ENSURE PERSONNEL AND EQUIPMENT ARE CLEAR OF RAT DOORS AND DEPLOYMENT PATH. DO NOT STAND DIRECTLY AFT OF RAT DOOR AREA WHEN ACTUATING DEPLOYMENT SWITCH.

(5) Remove ram air turbine ground safety lock from RAT doors (Ref. 29-21-00, 201 Para. 3B).

(6) On the ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, zone 147, place switch to DEPLOY and verify the following:

(a) RAT doors open smoothly with no binding or interference and RAT deploys fully to the down-locked position.

(b) The pilots caution and warning annunciator light RAT DEPLOYED comes on.

(c) The UNLKD legend on Flight Engineer/Second Officers RAM AIR TURBINE switchlight, zone 215, comes on.

(7) If Spin-Up Test, Paragraph C, is not required, restow the RAT (Ref. 29-21-10).

(8) On RAT uplock assembly, remove plastic cap from receptacle and connect electrical connector to squib actuator assembly.

(9) Turn off electrical power if no longer required (Ref. 24-41-00).

(10) Remove tag and close circuit breaker opened in Step 4B(1).

(11) Close and lock the hydraulic service center door 147 AB.

C. Ram Air Turbine Spin-Up Test

WARNING: PERFORM RAM AIR TURBINE SPIN-UP TEST WITH TURBINE IN SAFETY CAGE.

DO NOT PERFORM RAM AIR TURBINE SPIN-UP TEST IF RAM AIR TURBINE HUB FORE AND AFT MOVEMENT EXCEEDS 0.010 INCH.

(1) Check Ram Air Turbine (RAT) hub assembly for fore and aft movement. If movement exceeds 0.010 inch replace RAT.

R (2) Configure circuit breakers as follows:

R (a) On pilots overhead circuit breaker panel CB1:

R Verify closed

R RAT AUTO DEPLOY (L3)

R IND LT RAT (G10)

(3) Check the RAT blocked filter indicator (located on gearbox right side, upper forward area) as follows:

(a) Verify indicator button has not extended.

(b) If button is extended, remove filter element, clean cavity, replace with new element and reset indicator button. Filter element is located on aft face of gearbox.

(4) Install ram air turbine safety cage as follows (Ref. Fig. 501):

(a) Roll ram air turbine safety cage under RAT.

(b) Jack safety cage to proximity of aircraft fuselage and set safety cage ram safety lock.

(c) Verify turbine is centered in cage and set safety cage castor lock.

(5) On ram air turbine GROUND TEST panel in the Hydraulic Service Center, disconnect aircraft electrical connector and attach ground checkout electrical unit (GCEU) electrical cable (CA1) connector to panel receptacle.

(6) Turn on electrical power (Ref. 24-41-00).

NOTE: Verify left and right MLG proximity sensors simulate an on-ground condition.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

ENSURE THAT PERSONNEL AND EQUIPMENT ARE CLEAR OF THE TURBINE BLADES DURING SPIN-UP TEST.

(7) Turn on hydraulic pressure using system B ATM pump or a hydraulic ground power unit (Ref. 29-11-00): verify RAT does not spin.

NOTE: RAT requires 17 gpm minimum to achieve required spin-up speed.

(8) On GCEU panel, place switch to SPIN and hold for spin duration at 2 minutes minimum.

(9) Verify turbine blades spin up to operational speed and stabilize, indicated by GCEU GOVERNOR light coming on.

NOTE: Failure of this light to come on may be caused by a faulty GCEU. The aircraft system may be verified by use of a strobe tachometer to measure RAT blade speed. If the blade is within

the range of 5010-5390 rpm, the aircraft system may be considered serviceable.

(10) Release SPIN test switch, and verify the following:

(a) The Flight Engineer/Second Officers RAM AIR TURBINE deploy switchlight PRESS legend comes on momentarily as the turbine spins down, functioning as a pump and delivering pressure into system B.

(b) The OIL PRESSURE light on GCEU also comes on momentarily verifying RAT pump is developing pressure.

(11) Remove ram air turbine safety cage.

(12) Disconnect GCEU electrical connector from RAT GROUND TEST panel and reconnect aircraft electrical harness connector to panel receptacle.

(13) Verify RAT blocked filter indicator button has not extended [Ref. Step (3)].

(14) Restow RAT (Ref. 29-21-10, Maintenance Practices).

(15) Verify hydraulic system B reservoir fluid level is as required; replenish if necessary (Ref. 12-13-01).

(16) Turn off hydraulic pressure if no longer required (Ref. 29-11-00).

(17) Turn off electrical power if no longer required (Ref. 24-41-00).

D. Auto Deploy Circuit Test

R (1) Configure circuit breakers as follows:

R (a) On the pilots overhead circuit breaker panel CB1:

R Open and tag

R RAT MAN DEPLOY (B14)

R Verify closed

R TACH N3 - ENG 1 (E10)

R TACH N3 - ENG 2 (E11)

R TACH N3 - ENG 3 (E12)

R HP3 BLEED AIR - ENG 1 (E16)

R HP3 BLEED AIR - ENG 2 (E17)

R HP3 BLEED AIR - ENG 3 (E18)

R IND LT RAT (H10)

R RAT AUTO DEPLOY (L3)

R LANDING GEAR - PROX SW PWR - NO. 1 (L10)

R LANDING GEAR - PROX SW PWR - NO. 4 (L11)

R (b) On Flight Engineer/Second Officers overhead
R circuit breaker panel CB2:

R Verify closed

R MLG GND SENSE (L8)

(2) Verify RAT SAFETY LOCK ASSEMBLY is installed across RAT doors (Ref. 29-21-00).

(3) Disconnect the squib harness connector.

(4) Turn on electrical power (Ref. 24-41-00).

(5) Simulate an in-air condition by using appropriate targets (Ref. 32-63-00).

(6) Establish communication between hydraulic service center, zone 147, and flight station (Flight Engineer/Second Officers panel, zone 215).

(7) On the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, verify PUMP S/O and SUCT S/O switchlights are in OFF (released) position.

(8) Verify no voltage at pins 2 and 6 to ground of squib connector (Ref. 2921-P26).

(9) Verify B & C ATM switches are in OFF position.

R (10) On the pilots overhead circuit breaker panel CB1:

R Open and tag

R HP BLEED AIR - ENG 1 (E16)

(11) Disconnect the Captain and First Officers MACH AIR SPEED indicator electrical connector at the instruments.

(12) Disconnect the RAT unlock actuator harness connector (Ref. 2921-P27).

(13) On the Captains disconnected MACH AIR SPEED indicator harness, connect the test jumper plug or install jumper wire between pins 15 and 16 (Ref. 3414-P22).

NOTE: This establishes a greater than 100-Knot airspeed indication signal for test purposes.

(14) Verify 28V dc at RAT uplock actuator harness connector pin 4; use pin 1 for ground when checking voltage at pin 4.

(15) Install a 500-ohm resistor (5 watt rating minimum) from pin 4 to ground.

NOTE: Resistor simulates actuator motor load in following step.

(16) Break the circuit by positioning the following switches or switchlights in the ON or normal (flowbar on) condition individually and then back to the OFF position to determine that each switch or switchlight functions to complete or break the auto-deploy circuit to circuit to the RAT uplock actuator (Pin 4) as follows:

(a) Verify all pump control switches or switchlights are OFF.

(b) Position ATM rotary switch for system B to ON and verify no voltage at pin 4; return switch to OFF.

(c) Repeat Step (b) for ATM rotary switch system C.

(d) Position system A PUMP S/O and SUCT S/O switchlight to ON; verify no voltage at pin 4. Reposition PUMP S/O switchlight to OFF; verify 28V dc at pin 4. Reposition PUMP S/O switchlight to ON and position SUCT S/O to OFF; verify 28V dc at pin 4. Reposition PUMP S/O switchlight to OFF.

(e) Repeat Step (d) for systems B, C, and D.

(17) Position either system B or C ATM rotary switch to ON to break pump control auto deploy circuit.

(18) Test auto-deploy circuit through the engine N3 51 percent tach relays which are energized by:

HP3 BLEED AIR - ENG 1, 2, 3 (E16, E17, E18) circuit breakers on the pilots overhead circuit breaker panel CB1.

Open and close the following circuit breakers and check for voltage on pin 4 of the uplock actuator:

(a) Close circuit breaker HP3 BLEED AIR - ENG 1 (E16) and verify 28V dc at pin 4.

(b) Open circuit breaker HP3 BLEED AIR - ENG 2 (E17) and verify no voltage at pin 4.

(c) Close circuit breaker HP3 BLEED AIR - ENG 2 (E17) and verify 28V dc at pin 4.

(d) Open circuit breaker HP3 BLEED AIR - ENG 3 (E18) and verify no voltage at pin 4.

(e) Close circuit breaker HP3 BLEED AIR - ENG 3 (E18) and verify 28V dc at pin 4.

NOTE: Use 500 ohm resistor between pin 4 and ground when reading no voltage.

(19) Remove the test jumper plug or jumper wire installed on the Captains disconnected MACH AIR SPEED indicator harness between pins 15 and 16 [Ref. Step (13)], and verify no voltage at pin 4; use pin 1 for ground.

(20) Install the test jumper plug or jumper wire (between pins 15 and 16 of 3414-P23) on the co-pilots disconnected MACH AIR SPEED indicator harness and verify 28V dc at pin 4 of the RAT uplock actuator connector; use pin 1 for ground.

(21) Remove test jumper plug or jumper wire from co-pilots MACH AIR SPEED indicator harness connector and reconnect harness to indicator.

(22) Reconnect Captains MACH AIR SPEED indicator harness connector.

(23) Turn off electrical power if no longer required (Ref. 24-41-00).

(24) Reconnect RAT uplock actuator harness connector.

(25) Reconnect squib actuator harness connector.

(26) Close and lock hydraulic service center access door.

E. Auto Reset Circuit Test

(1) Verify RAT SAFETY BAR is installed across the RAT doors.

R (2) Configure circuit breakers as follows:

R (a) On pilots overhead circuit breaker panel CB1:

R Open and tag

R RAT MAN DEPLOY (B14)

R Veriiy closed

R RAT AUTO DEPLOY (L3)

(3) Open hydraulic service center access door 147 AB, and gain access the RAT uplock actuator.

(4) Disconnect electrical harness connectors from squib actuator and uplock motor actuator.

(5) If aircraft is on jacks, simulate an on-ground condition using appropriate MLG proximity sensor target set.

(6) Gain access to the FESC; on the aft right side, locate the ENG OUT LIGHT ARMED RELAY (ARMED RELAY, 7714-K1).

(7) Remove the ARMED RELAY and install a jumper wire between D1 and D2 of the relay socket.

(8) Turn on electrical power (Ref. 24-41-00).

(9) Verify 28V dc at pin 3 of uplock actuator connector.

(10) Simulate an in-air condition at the MLG proximity sensor using the appropriate target set.

(11) Verify no voltage at pin 3 of the RAT uplock actuator harness connector and no voltage at pins 2 and 6 of the squib actuator harness connector.

(12) Remove jumper wire from the ARMED RELAY socket and reinstall the relay

(13) Shut off electrical power if no longer required (Ref. 24-41-00).

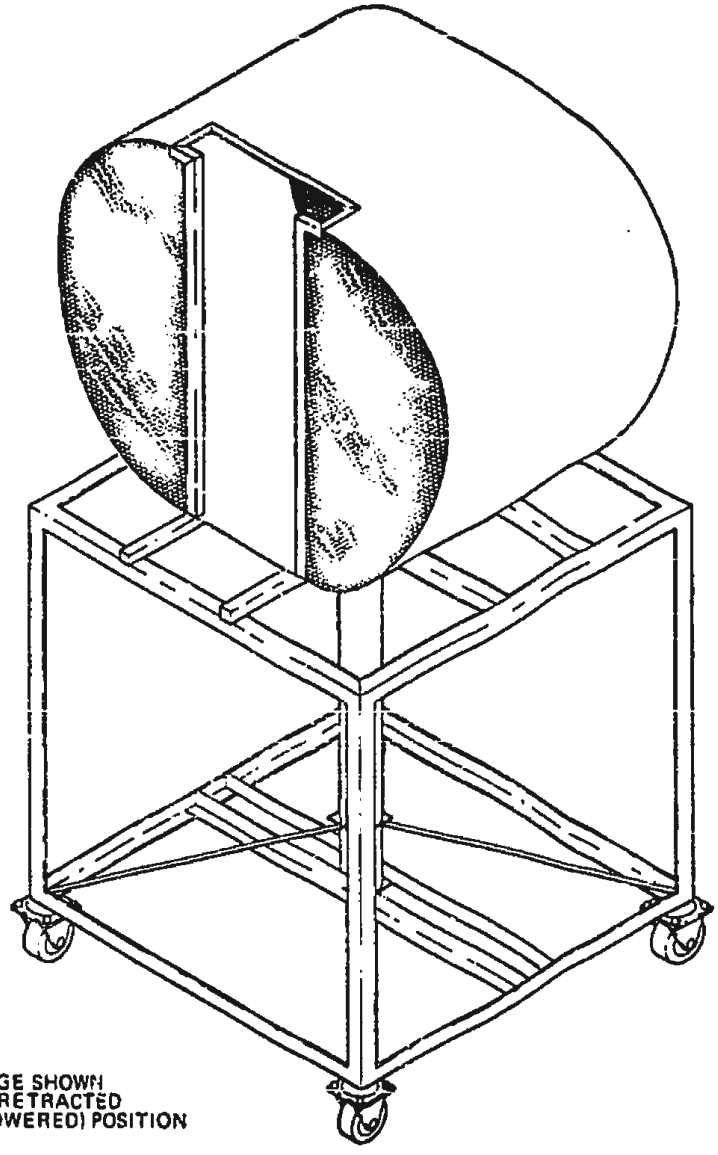
(14) Close FESC access door.

(15) Reconnect RAT uplock actuator and squib actuator harness connectors.

(16) Close and lock hydraulic service center door.

CAUTION: BE SURE ALL ARTIFICIAL TARGETS ARE REMOVED FROM AIR/GROUND SENSORS.

(17) Remove target from MLG proximity sensor.



NOTE: CAGE SHOWN IN RETRACTED (LOWERED) POSITION

M1-0000-29-901

Ram Air Turbine Safety Cage
Figure 501

RAM AIR TURBINE - MAINTENANCE PRACTICES

1. General

R The Ram Air Turbine restowing procedure provides directions for restowing the turbine following deployment. Prior to restowing, the RAT system should be inspected for security of the door rods, freedom of movement and adequate lubrication of all hinges, clevis and swivels. The blocked filter indicator should be inspected to verify that the indicator button has not extended (indicator is located on forward right side of RAT gearbox). If button is extended, remove and replace filter element. Ram air turbine blades should be inspected for general condition. If any blade damage is visible, refer to 29-21-10, Approved Repairs.

2. Equipment and Materials

Aircraft Components Portable Hoist,WE3981, or equivalent

Ram Air Turbine Stowing Sling, BF84, or equivalent

Lubricant, VV-L-800, or equivalent

Breakaway Wire, Fed Spec QQ-W-321, 0.0125-inch diameter, or equivalent.

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-21-00	Ram Air Turbine - Maintenance Practices
29-21-00	Ram Air Turbine - Adjustment and Test
29-21-10	Ram Air Turbine - Approved Repairs

4. Restowing

R R NOTE: If the squib has been fired it must be removed and replaced prior to restowing.

A. Ram Air Turbine

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breaker RAT AUTO DEPLOY (L3) is closed. Open and tag circuit breaker RAT MAN DEPLOY (B14).

(2) Disconnect electrical connector from uplock squib actuator. Cover receptacle with plastic cap.

NOTE: If the aircraft is on jacks, simulate an on-ground condition at NLG and left MLG proximity sensors by using the appropriate targets.

(3) Turn on electrical power (Ref. 24-41-00).

(4) Open forward hydraulic service center door, zone 147.

(5) On ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, lift guard and position switch to RESET; verify that the ENGAGED light comes on.

R (6) Gain access to RAT as follows:

R (a) Open access panel 142GB located forward of RAT
R (Ref. 6-40-00).

R (b) On aircraft 025, 026, 028-999,
R open zipper door in airflow barrier.

(7) Insert portable hoist (fishpole) through access opening and attach to aircraft structure hardpoint above RAT assembly.

(8) Lower hoist cable through RAT door opening.

(9) Attach RAT stowing sling to support leg attaching holes (Ref. Fig. 201).

(10) Attach hoist cable to stowing sling.

(11) On the turbine support leg trunnion, right side, pull out on turbine downlock plunger and swing turbine forward approximately 15 degrees; take up slack on cable with hoist.

(12) Position blades in vertical position and verify that blade lock plunger enters blade locking tab on aft side of blade and hub.

WARNING: DURING RETRACTION ENSURE THAT BLADES LOCK IN VERTICAL POSITION.

(13) Operate hoist to swing RAT toward stowed position; observe stowing sling clearance while passing through door opening. Stop hoist when uplock hook rotates to locked position. Do not apply excessive lift force to uplock assembly.

NOTE: Locking is automatic and is indicated as uplock roller engages upper part of hook causing it to snap into locked position with an audible click.

(14) Verify that assembly is in full uplock position by depressing uplock indicator button; zero clearance between underside of button head and housing indicates full uplock position.

(15) Reverse hoist and lower RAT until it is supported by the uplock hook. Recheck uplock position indicator.

(16) Lower switch guard over ram air turbine ground test switch and safety with breakaway wire.

(17) Install ram air turbine ground safety lock over RAT doors (Ref. 29-21-00).

(18) Disconnect hoist cable from RAT stowing sling and remove sling.

(19) Disconnect portable hoist from aircraft hardpoint and remove through panel opening.

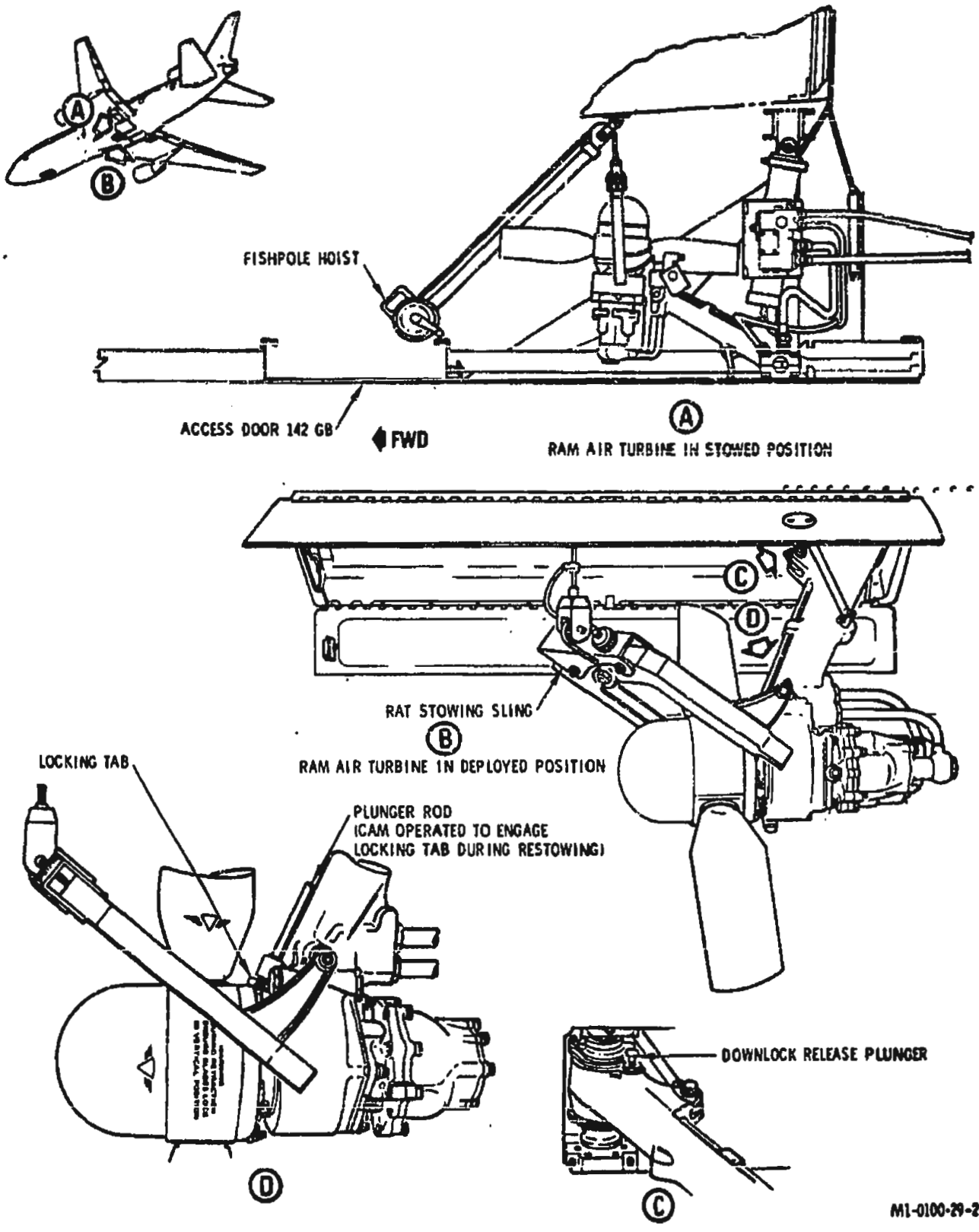
R (20) Turn off electrical power (Ref. 24-41-00).

(21) Remove plastic cap and reconnect electrical connector to uplock squib actuator.

R (22) On aircraft 001-024, 027,
R reinstall 142GB access panel.

R (22) On aircraft 025, 026, 028-999,
R close zipper door in airflow barrier and reinstall
R 142GB access panel.

(23) Close and lock hydraulic service center access doors.



R R Ram Air Turbine Restowing
Figure 201

R R 001B EFFECTIVITY: ALL

RAM AIR TURBINE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid Container, 3-gallon plastic pail, or equivalent

Hydraulic Fluid, LAC Spec C34-1224, or equivalent

Protective caps and plugs

Aircraft Components Portable Hoist, WE3981, or equivalent

Ram Air Turbine Stowing Sling, BF84, or equivalent

Flight Line Test Actuator and Deactuator Targets Set, EDC Model 8-005101-01, or equivalent

R Breakaway Wire, Fed Spec QQ-W-321, 0.0125-inch diameter, or equivalent

Lubricant, VV-L-800, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-13-00	Hydraulic Fluid Replenishing - Servicing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-21-00	Ram Air Turbine - Adjustment and Test
29-21-10	Ram Air Turbine - Maintenance Practices
52-45-02	Ram Air Turbine Doors - Removal and Installation

3. Removal/Installation

A. Removal

(1) Disconnect electrical connector from ram air turbine (RAT) uplock squib actuator assembly. Cover receptacle with plastic cap.

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker RAT MAN DEPLOY (B14) and IND LT RAT (H10).

(3) Deploy RAT as follows:

R R R (a) On pilots overhead circuit breaker panel CB1, open and tag circuit breaker THRUST REVERSE ENG 2 (H17) and verify circuit breaker RAT AUTO DEPLOY (L3) is closed.

NOTE: If the aircraft is on jacks, simulate an on-ground condition at NLG and left MLG proximity sensors by using appropriate targets.

(b) Turn on electrical power (Ref. 24-41-00).

(c) Open hydraulic service center doors 147AB and 147BB.

(d) Remove ram air turbine ground safety lock from RAT door area (Ref. 29-21-00, 201 Para. 3B).

WARNING: BEFORE DEPLOYING RAT TAKE EXTREME PRECAUTION TO ENSURE THAT THE RAT DOOR AND TRAVEL AREA IS CLEAR OF ALL EQUIPMENT AND PERSONNEL. RAT DEPLOYMENT IS EXPLOSIVELY FAST. DO NOT STAND DIRECTLY AFT OF RAT WHILE ACTUATING SWITCH.

(e) On ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, zone 147, lift guard and position switch to DEPLOY.

(f) Turn off electrical power (Ref. 24-41-00).

(4) On pilots overhead circuit breaker panel CB1, open and tag circuit breaker RAT AUTO DEPLOY (L3).

(5) Disconnect RAT electrical cable connector from receptacle located between RAT and HYDRAULIC SERVICE PANEL, right side (Ref. Fig. 401).

(6) Disconnect door rods at ram air turbine support leg swivel fittings.

(7) Verify that system B hydraulic system is shut off (Ref. 29-11-00).

(8) Place tags on Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and on the HYDRAULIC SERVICE PANEL, zone 147.

WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

(9) Depressurize system B reservoir by actuating reservoir depressurization valve at base of reservoir until B SYS RESERVOIR PRESSURE gage on HYDRAULIC SERVICE PANEL indicates zero psi. Ensure that depressurization valve returns fully to normal position when released.

(10) Drain system B reservoir as follows:

(a) Place fluid container under drain plug.

(b) Remove drain plug.

(c) Open air bleed valve at bottom of reservoir pressurization piston.

(d) When fluid is drained, close air bleed valve; reinstall drain plug and lock-wire.

(11) Place fluid container under ram air turbine trunnion and disconnect hydraulic tube fittings from trunnion fittings. Place protective caps and plugs on fittings.

(12) Remove deployment actuator attaching bolt at support leg attaching fitting.

(13) Remove ram air turbine mounting bolts from clamp blocks on left side and from mounting lug on right side.

(14) Open access panel 142GB, located forward at ram air turbine (Ref. 6-40-00).

(15) Insert portable hoist (fishpole) through access opening and attach to aircraft structure hardpoint above ram air turbine.

(16) Lower hoist cable and attach to turbine support leg at deployment actuator attach fitting.

CAUTION: RESTRAIN TURBINE ASSEMBLY AGAINST A FORWARD MOVEMENT; STRUCTURE HARDPOINT IS FORWARD OF THE TURBINE ASSEMBLY CENTER-OF-LIFT.

(17) Apply lifting force to turbine assembly and lift out of clamp block. (Assembly weighs approximately 65 pounds.) Rotate assembly to clear trunnion through opening and doors.

CAUTION: USE EXTREME CARE TO PREVENT DAMAGE TO TURBINE BLADES WHILE HANDLING TURBINE ASSEMBLY.

(18) Lower turbine assembly to ground.

(19) Disconnect hoist cable from turbine support leg fitting.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(2) are open and tagged.

(2) Attach portable hoist to aircraft structure hardpoint above ram air turbine installation.

(3) Attach hoist cable to turbine support leg at deployment actuator attach fitting.

(4) Check that turbine assembly pivot shaft and mounting clamp area are clean.

WARNING: USE CARE TO PREVENT DAMAGE TO TURBINE BLADES AND DOORS DURING INSTALLATION.

(5) Operate hoist to lift ram air turbine assembly through door and position in clamp block.

(6) Install bolt in mounting lug on right side.

(7) Position upper clamp block in place to match lower clamp block holes and install bolts.

(8) Disconnect hoist cable from turbine support leg and install bolt through actuator rod end fitting and support leg fitting. Tighten bolt to 220 lb in.

(9) Connect RAT electrical cable connector to receptacle located between RAT and HYDRAULIC SERVICE PANEL, right side.

C CAUTION: POSITION THE ADAPTER FITTING IN THE INLET PORT
C (SUCTION TUBE) SO THAT NO PART OF THE HEX FLATS
CR EXTEND BEYOND THE INBOARD VERTICAL SURFACE OF THE
C POST. SEE FIGURE 402 FOR DETAIL .

(10) Remove protective plugs and caps, and connect pressure and suction tube fittings to trunnion fittings.

(11) Verify system B reservoir drain plug is installed and lock-wired. Fill reservoir and perform air bleed procedures in accordance with RESERVOIR SERVICING and HYDRAULIC SERVICE PANEL placards (Ref. 12-13-00).

(12) With hydraulic pressure applied check for leakage at trunnion fittings.

(13) With RAT doors disconnected, raise RAT as specified in Para. 4A, Step (1) through (14).

(14) Check uplock indicator button; if button does not bottom, check that hook and roller clearance is 0.010 to 0.015 inch. Uplock hook and roller adjustment is accomplished as follows:

(a) Support RAT assembly with hoist and rotate manual release (7/16-inch hex on left side of uplock).

(b) Lower RAT until roller is accessible.

(c) Loosen locknut until eccentric bushing can be pulled out clear of dowel pin.

(d) Rotate eccentric bushing to obtain desired uplock hook/roller clearance.

(e) Reposition bushing on dowel pin and tighten roller retaining locknut.

(f) Hoist RAT up until uplock hook rotates into locked position. Recheck hook/roller clearance.

(g) Repeat adjustment as necessary to obtain 0.010 to 0.015-inch hook/roller clearance.

(15) Perform RAT door adjustment (Ref. 52-45-02).

(16) Manually release uplock and lower RAT. Complete door adjustment (connect door rods, install cotter pins and lubricate connections as required).

(17) Restow RAT using procedures specified in Para. 4.

(18) Perform Deployment and Spin-up Tests (Ref. 29-21-00, Adjustment and Test, Para. 4B and 4C).

R (19) Remove tags and close circuit breakers opened in Steps 3A(2) through (4).

4. Restowing

A. Ram Air Turbine

(1) Disconnect electrical connector from uplock squib actuator. Cover receptacle with plastic cap.

(2) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breaker RAT AUTO DEPLOY (L3) is closed.

NOTE: If the aircraft is on jacks, simulate an on-ground condition at NLG and left MLG proximity sensors by using the appropriate targets.

(3) Turn on electrical power (Ref. 24-41-00).

(4) Open forward hydraulic service center door, zone 147.

(5) On ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, lift guard and position switch to RESET; verify that the ENGAGED light comes on.

(6) Open access panel 142GB located forward of RAT (Ref. 6-40-00).

(7) Insert portable hoist (fishpole) through access opening and attach to aircraft structure hardpoint above RAT assembly.

(8) Lower hoist cable through RAT door opening.

(9) Attach RAT stowing sling to support leg attaching holes (Ref. Fig. 401).

(10) Attach hoist cable to stowing sling.

(11) On the turbine support leg trunnion, right side, pull out on turbine downlock plunger and swing turbine forward approximately 15 degrees; take up slack on cable with hoist.

(12) Position blades in vertical position and verify that blade lock plunger enters blade locking tab on aft side of blade and hub.

WARNING: DURING RETRACTION ENSURE THAT BLADES LOCK IN VERTICAL POSITION.

(13) Operate hoist to swing RAT toward stowed position; observe stowing sling clearance while passing through door opening. Stop hoist when uplock hook rotates to locked position. Do not apply excessive lift force to uplock assembly.

NOTE: Locking is automatic and is indicated as uplock roller engages upper part of hook causing it to snap into locked position with an audible click.

(14) Verify that assembly is in full uplock position by depressing uplock indicator button; zero clearance between underside of button head and housing indicates full uplock position.

(15) Reverse hoist and lower RAT until it is supported by the uplock hook. Recheck uplock position indicator.

(16) Lower switch guard over ram air turbine ground test switch and safety with breakaway wire.

(17) Install ram air turbine ground safety lock over RAT doors (Ref. 29-21-00).

(18) Disconnect hoist cable from RAT stowing sling and remove sling.

CAUTION: ON AIRCRAFT WITH AIRFLOW BARRIER FORWARD OF RAT VERIFY THAT ZIPPER DOOR IN AIRFLOW BARRIER IS CLOSED.

(19) Disconnect portable hoist from aircraft hardpoint and remove through access panel opening; reinstall 142GB panel.

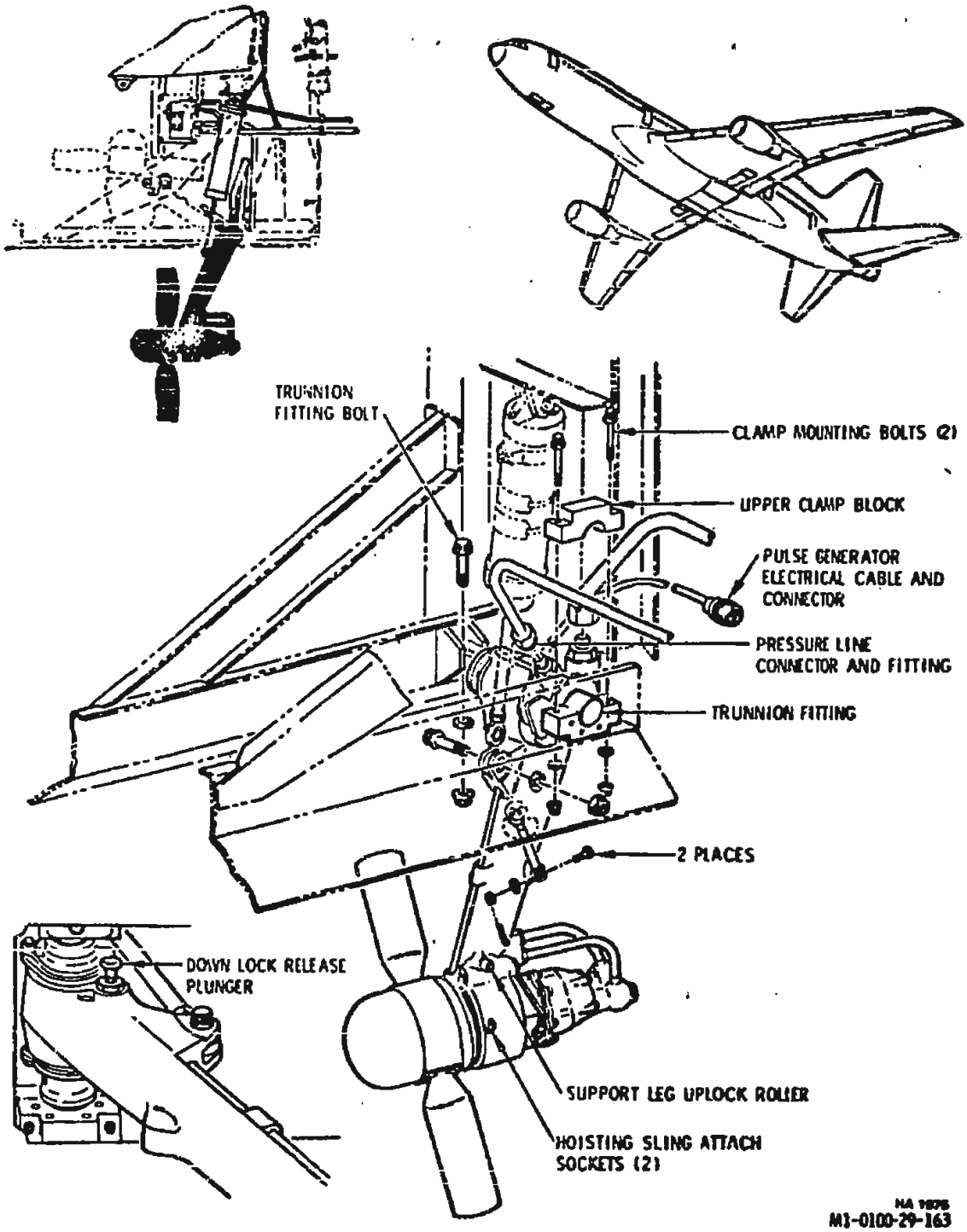
(20) Turn off electrical power (Ref. 24-41-00).

(21) Remove plastic cap and reconnect electrical connector to uplock squib actuator.

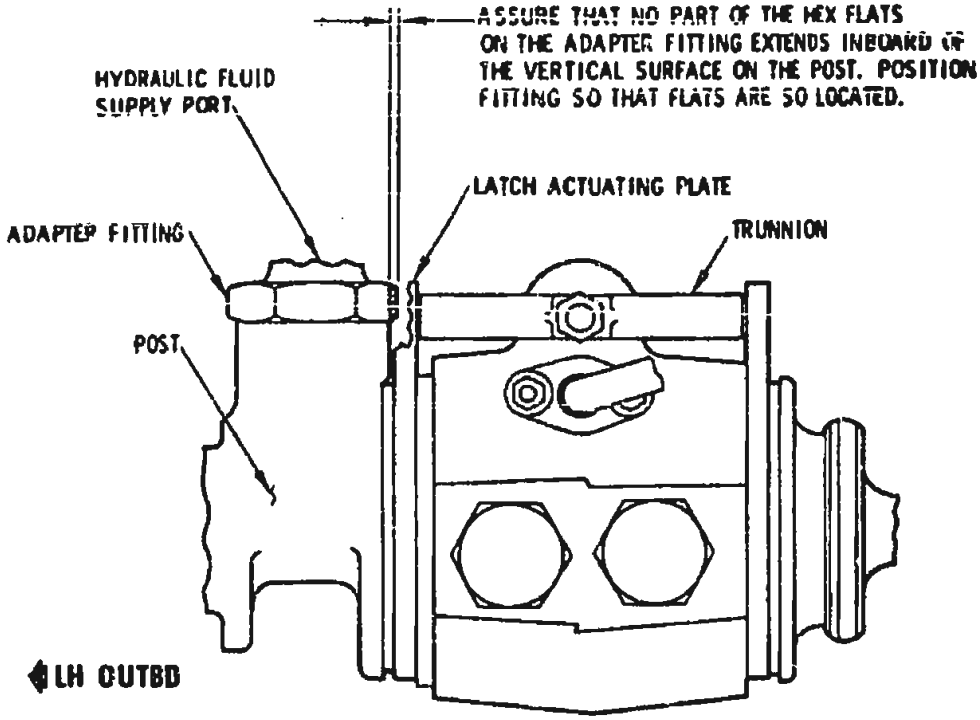
(22) Close and lock hydraulic service center access doors.

R CAUTION: BE SURE ALL ARTIFICIAL TARGETS ARE REMOVED FROM
R AIR/GROUND SENSORS.

(23) Remove targets from NLG and left MLG proximity sensors.



R R Ram Air Turbine - Removal and Installation
Figure 401


ASSURE THAT NO PART OF THE HEX FLATS ON THE ADAPTER FITTING EXTENDS INBOARD OF THE VERTICAL SURFACE ON THE POST. POSITION FITTING SO THAT FLATS ARE SO LOCATED.
HYDRAULIC FLUID SUPPLY PORT
LATCH ACTUATING PLATE
ADAPTER FITTING
TRUNNION
POST
LH OUTBD

M1-0000-29-004

R Ram Air Turbine - Hydraulic Fittings
R Figure 402

R EFFECTIVITY: ALL
R
001B

R

RAM AIR TURBINE - APPROVED REPAIRS

R 1. General

R The ram air turbine blades may incur minor blade damage during R normal service life that is repairable if not beyond the limits R as specified in the following paragraphs.

R No repairs are permitted within two inches of hub.

R 2. Ram Air Turbine Minor Blade Repairs

R A. Leading and Trailing Edges

R (1) Damage is acceptable if, when adequately blended, the R reduction in local chord is less than 5 percent.

R (2) Blending is to be carried out smoothly over a length R equivalent to at least 5 times depth of damage in both R directions.

R (3) The summation of blend-out lengths on any one edge must R not exceed 5 inches.

R B. Faces

R (1) Damage is acceptable if, when adequately blended, the R reduction in local blade thickness is less than 10 R percent.

R (2) Blending is to be carried out smoothly in all R directions over an area having a radius at least 10 R times depth of damage.

R (3) Indentations deeper than 0.020 inch are not acceptable R if the summation of their blend-out lengths exceeds 2.0 R inches. The summation includes both faces.

R (4) Indentations deeper than 0.040 inch are not acceptable.

R C. Tip

R (1) Damage to the tip corner is acceptable if it does not R extend beyond a diagonal line of 0.7 inch maximum R length drawn across the corner.

R (2) Blending is to be carried out in all directions.

R D. Balancing

(1) If the total amount of material removed since the blades were last balanced exceeds the equivalent of two maximum single repairs in accordance with Paragraphs A and C, the blades must be rebalanced as a pair.

E. Crack Testing

(1) Reworked areas are to be tested in accordance with specification NDT 8 (Zyglow dye penetrant).

R F. Bent Blades

R (1) Replace blade assembly is a blade is bent.

RAM AIR TURBINE DEPLOYMENT ACTUATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Hydraulic Fluid, LAC Spec C34-1224, or equivalent

Aircraft Components Portable Hoist, WE3981, or equivalent

Ram Air Turbine Stowing Sling BF84, or equivalent

Flight Line Test Actuator and Deactuator Targets Set, EDC Model 8-005101-01, or equivalent

Lubricant, VV-L-800, or equivalent

2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
	20-31-01	Proximity Sensor Artificial Target - Maintenance Practices
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-21-00	Ram Air Turbine System - Adjustment and Test
	29-21-10	Ram Air Turbine - Removal and Installation

3. Removal/Installation

A. Removal

(1) Disconnect electrical connector from ram air turbine (RAT) uplock squib actuator. Cover receptacle with plastic cap.

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker RAT MAN DEPLOY (B14).

(3) Deploy RAT as follows:

(a) On pilots overhead circuit breaker panel CB1, verify that circuit breaker RAT AUTO DEPLOY (L3) is closed.

(b) If aircraft is on jacks, simulate an on-ground condition by placing steel artificial targets

between NLG and MLG sensors and targets (Ref. 20-31-01).

(c) Turn on electrical power (Ref. 24-41-00).

(d) Remove RAT ground safety lock from RAT doors.

WARNING: BEFORE DEPLOYING RAT TAKE EXTREME PRECAUTION TO ENSURE THAT THE RAT DOOR AND TRAVEL AREA IS CLEAR OF ALL EQUIPMENT AND PERSONNEL. RAT DEPLOYMENT IS EXPLOSIVELY FAST. DO NOT STAND DIRECTLY AFT OF RAT WHILE ACTUATING SWITCH.

(e) Open hydraulic service center 147AB and 147BB doors, and on ram air turbine GROUND TEST panel located below HYDRAULIC SERVICE PANEL, zone 147, lift guard and place switch to DEPLOY (Ref 6-40-00).

(f) Turn off electrical power (Ref. 24-41-00).

(g) On pilots overhead circuit breaker panel CB1, open and tag circuit breaker RAT AUTO DEPLOY (L3).

(4) Remove bolt from deployment actuator and turbine support leg attach fitting (Ref. Fig. 401).

(5) Remove nut from upper actuator attach bolt.

(6) Support actuator weight (approximately 15 pounds), remove bolt and remove actuator from aircraft.

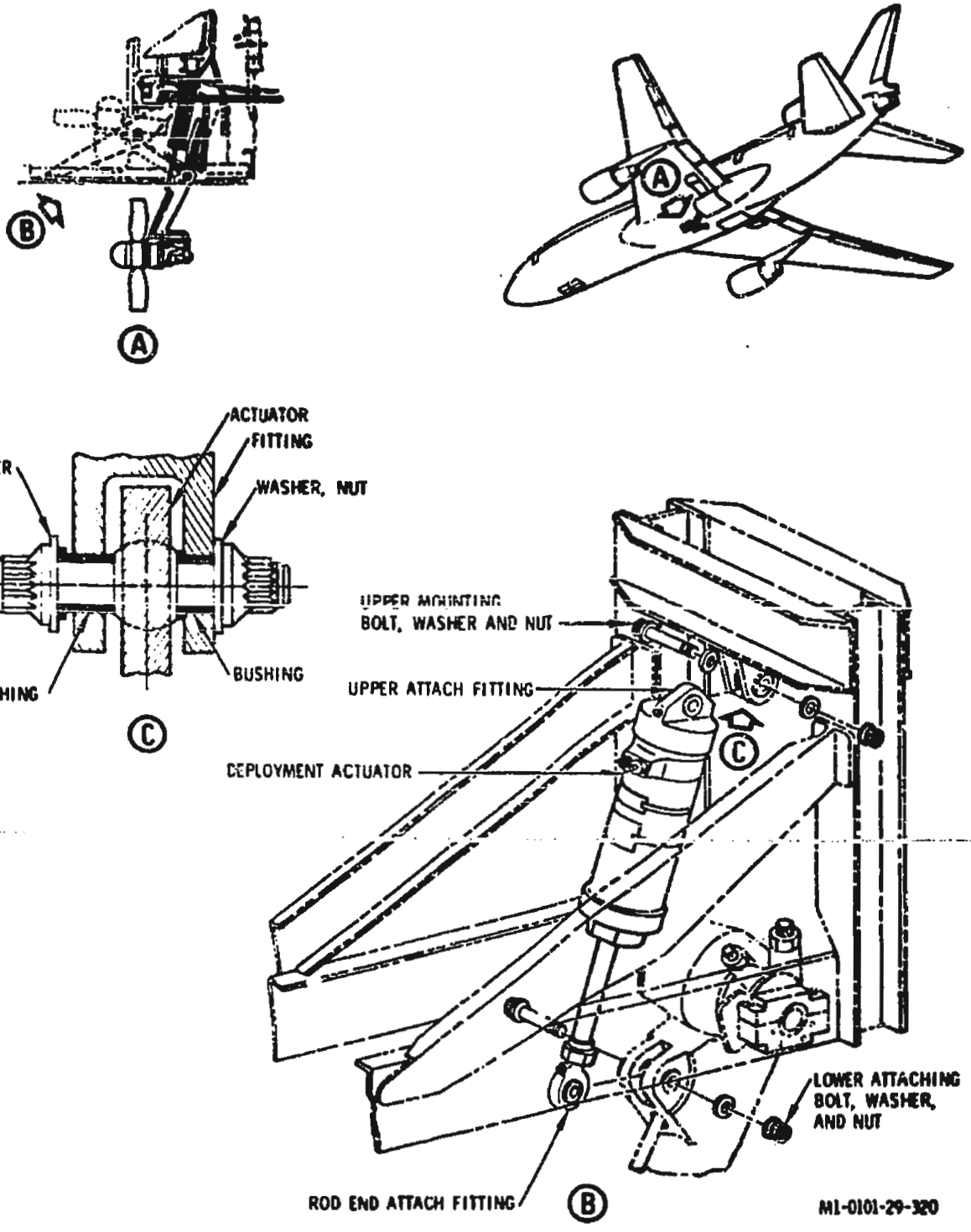
CAUTION: WITH DEPLOYMENT ACTUATOR REMOVED, DO NOT ALLOW TURBINE ASSEMBLY TO SWING DOWN INTO DEPLOYED POSITION. DAMAGE TO TRUNNION AND DOWNLOCK MAY OCCUR.

B. Installation

(1) Before installing RAT deployment actuator verify the following:

(a) Actuator extended length from rod end bearing to upper attaching bearing is 29.600 (±0.200) inches.

(b) Actuator is serviced with hydraulic fluid LAC Spec C34-1224 to the bleed port level with actuator held in same position as mounted in aircraft.



R R Ram Air Turbine Actuator - Removal and Installation
Figure 401

(c) Actuator upper mounting bracket, rod end, turbine attach fitting and bolts are all lubricated with VV-L-800 prior to installation.

(2) Position actuator in aircraft upper mounting bracket with servicing port and bleed screw forward, install washer on bolt, then insert bolt; install washer and nut and torque to 220 lb in. Verify that bushings are in position as shown on Figure 401.

(3) Place rod end fitting into turbine support leg attach fitting with lube fitting facing forward.

(4) Install bolt, washer and nut, and torque to 220 lb in.

R (5) Restow ram air turbine (Ref. 29-21-10).

(6) Remove artificial targets from between NLG and MLG air/ground safety sensors and targets.

R (7) Perform deployment test of ram air turbine system (Ref.
R 29-21-00).

(8) Remove plastic cap and reconnect electrical connector to uplock squib actuator.

(9) Remove tag and close circuit breaker opened in Step 3A(2).

(10) Close and lock hydraulic service center 147AB and 147BB
R doors (Ref. 6-40-00).

RAM AIR TURBINE UPLOCK - REMOVAL AND INSTALLATION

1. Equipment and Materials

Aircraft Component Portable Hoist, WE3981, or equivalent

Ram Air Turbine Stowing Sling, BF84, or equivalent

Breakaway Wire, Fed Spec QQ-W-321, 0.0125-inch diameter, or equivalent

Flight Line Test Actuator and Deactuator Target Set, EDC Model 8-005101-01, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-21-00	Ram Air Turbine System - Adjustment and Test
29-21-10	Ram Air Turbine - Removal and Installation

3. Removal/Installation

A. Removal

(1) Disconnect electrical connector from ram air turbine (RAT) uplock squib actuator. Cover receptacle with plastic cap.

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker RAT MAN DEPLOY (B14).

(3) Deploy RAT as follows:

NOTE: If the aircraft is on jacks, simulate an on-ground condition at NLG and left MLG proximity sensors by using appropriate targets.

R (a) On aircraft 001-033 without SB29-075,
R on pilot's overhead circuit breaker panel CB1,
R verify that circuit breakers RAT AUTO DEPLOY (L3)
R and IND LT RAT (H10) are closed.

R (a) On aircraft 001-033 with SB29-075 and 034-036,
R on pilot's overhead circuit breaker CB1, open and
R tag circuit breaker THRUST REVERSE ENG 2 (H17).
R Verify that circuit breakers RAY AUTO DEPLOY (L3)
R and IND LT RAT (H10) are closed.

(b) Turn on electrical power (Ref. 24-41-00).

(c) Open hydraulic service center access doors 147AB and 147BB, zone 147.

(d) Remove ram air turbine ground safety lock from RAT doors.

WARNING: BEFORE DEPLOYING RAT TAKE EXTREME PRECAUTION TO ENSURE THAT THE RAT DOOR AND TRAVEL AREA IS CLEAR OF PERSONNEL AND EQUIPMENT. RAT DEPLOYMENT IS EXPLOSIVELY FAST. DO NOT STAND DIRECTLY AFT OF RAT WHILE ACTUATING SWITCH.

(e) On ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, zone 147, lift switch guard and position switch to DEPLOY.

(f) Turn off electrical power (Ref. 24-41-00).

(4) On pilots overhead circuit breaker panel CB1, open and tag circuit breaker RAT AUTO DEPLOY (L3).

(5) Disconnect electrical connector from uplock motor actuator.

(6) Remove uplock mounting bolts and remove uplock from actuator.

NOTE: If spacer washers are used between uplock and aircraft structure, tag and note placement for replacement uplock.

B. Installation

(1) Verify that circuit breakers opened in Steps 3A(2) and 3A (4) are open and tagged.

(2) Place uplock in position and install mounting bolts.

NOTE: Reinstall spacer washers if used on removed uplock.

(3) Connect electrical connector to uplock motor actuator.

(4) On pilots overhead circuit breaker panel CB1, close RAT AUTO DEPLOY (L3) circuit breaker.

(5) On ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, zone 147, lift guard and position switch to RESET.

(6) Apply force to upper portion of uplock hook.

(7) Verify that hook rotates to locked condition, by depressing uplock indicator button on top of uplock; clearance between button head and body of between 0.00 and 0.001 inch indicates fully locked condition.

(8) Place GROUND TEST switch to DEPLOY while applying downward force on hook; verify that hook unlocks.

(9) Restow ram air turbine (Ref. Para. 4, 29-21-10, Removal and Installation).

(10) Verify that uplock hook is in full contact with turbine support leg mounted roller.

(a) If adjustment is required, lower RAT with hoist (use manual release hex shaft to unlock uplock).

(b) Install washers between uplock and structure to position uplock hook for desired roller contact.

(c) Hoist RAT up until uplock hook rotates into locked position.

(d) Reverse hoist to slacken hoisting cable.

(11) Verify that uplock position indicator button head clearance when depressed is 0.00 to 0.001 inch. If hook/roller adjustment is required proceed as follows:

(a) Take up slack on hoisting cable, rotate manual release hex shaft on uplock assembly to unlock uplock, then lower RAT until roller is accessible.

(b) Loosen eccentric bushing retainer locknut until bushing can be pulled out clear of the dowel pin.

(c) Rotate eccentric bushing to obtain desired uplock hook/roller clearance.

(d) Reposition bushing on dowel pin and tighten retainer locknut.

(e) Hoist RAT up until uplock hook rotates into locked position. Recheck indicator button head clearance.

(f) Repeat adjustment as necessary to obtain 0.00 to 0.001 inch indicator button head clearance.

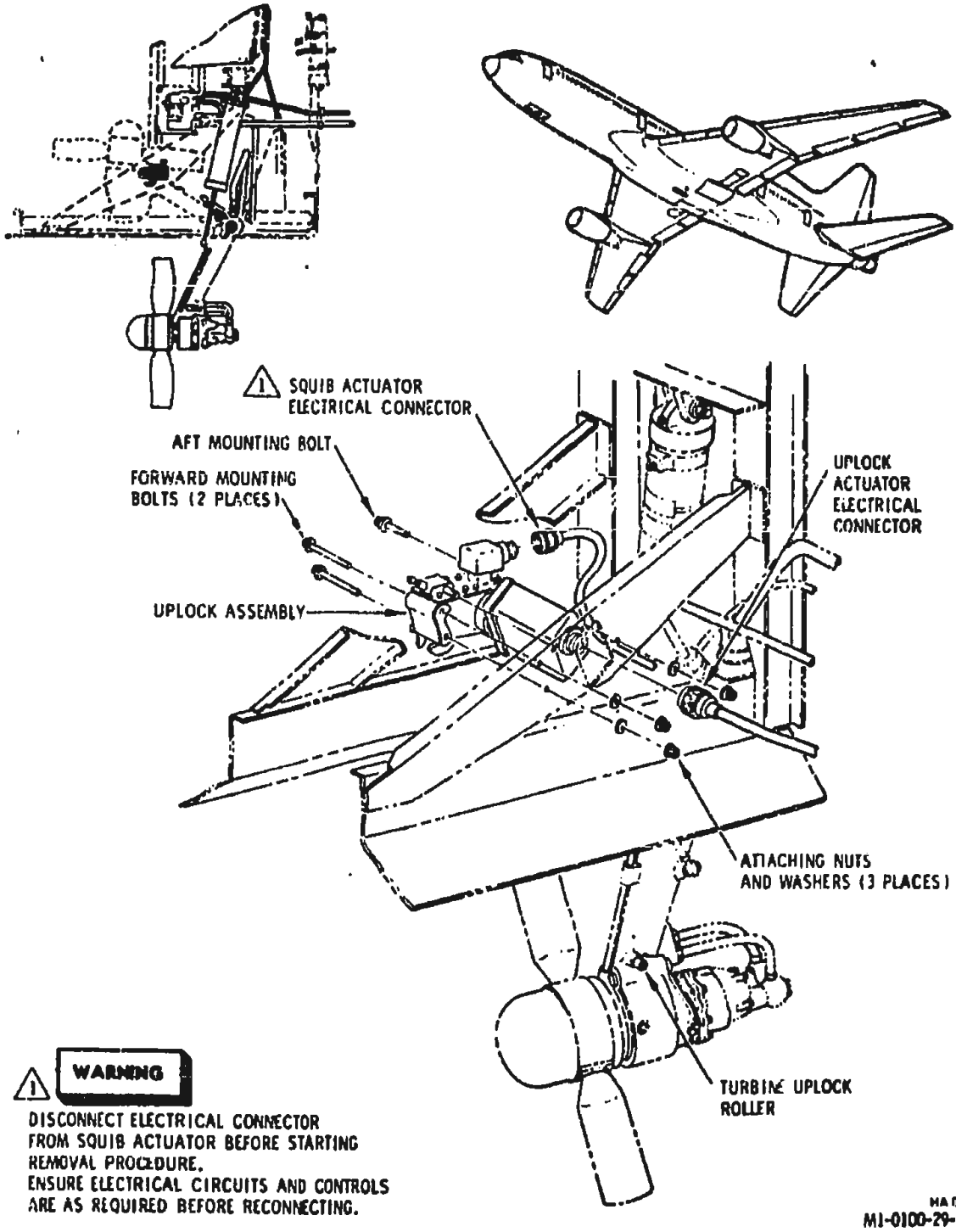
(12) Perform ram air turbine deployment test (Ref. 29-21-00, Adjustment and Test, Para. 4B).

(13) Remove plastic cap and reconnect electrical connector to uplock squib actuator.

R (14) Remove tags and close circuit breakers opened in Step 3A(2), 3A(3), and 3A(4).

(15) On ram air turbine GROUND TEST panel, lower switch guard and safety with breakaway wire.

(16) Close and lock hydraulic service center doors.


1 SQUIB ACTUATOR ELECTRICAL CONNECTOR
AFT MOUNTING BOLT
FORWARD MOUNTING BOLTS (2 PLACES)
UPLOCK ACTUATOR ELECTRICAL CONNECTOR
UPLOCK ASSEMBLY
ATTACHING NUTS AND WASHERS (3 PLACES)
TURBINE UPLOCK ROLLER
1 WARNING
DISCONNECT ELECTRICAL CONNECTOR FROM SQUIB ACTUATOR BEFORE STARTING REMOVAL PROCEDURE.
ENSURE ELECTRICAL CIRCUITS AND CONTROLS ARE AS REQUIRED BEFORE RECONNECTING.
MI-0100-29-165

Ram Air Turbine Uplock - Removal and Installation
Figure 401

RAM AIR TURBINE CONTROL MODULE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Fluid Container gallon plastic pail, or equivalent

Hydraulic Fluid LAC Spec C34-1224, or equivalent

Protective caps and plugs

Lock-wire Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

12-13-00	Hydraulic Fluid Replenishing - Servicing
29-11-00	Hydraulic Power System - Maintenances Practices
29-21-00	Ram Air Turbine System - Adjustment and Test

3. Removal/Installation

A. Removal

(1) Disconnect electrical connector from ram air turbine (RAT) uplock squib actuator. Cover receptacle with plastic cap.

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker RAT MAN DEPLOY (B14) and IND LT RAT (H10).

(3) Open hydraulic service center access doors 147AB and 147BB.

(4) Verify that system B hydraulic system is shut off (Ref. 29-11-00)

(5) Tag Flight Engineer/Second Officers HYDRAULIC SYSTEM PANEL, zone 215 and HYDRAULIC SERVICE PANEL, zone 147.

R

R
R
R
R

WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF. 29-11-00, 201).

(6) Depressurize system B reservoir by actuating reservoir depressurization valve at base of reservoir. Verify

zero psi at B SYS RESERVOIR PRESSURE gage on HYDRAULIC SERVICE PANEL.

(7) Drain system B reservoir as follows:

(a) Place fluid container under drain plug.

(b) Remove drain plug.

(c) Open air bleed valve at bottom of reservoir pressurization piston.

(d) When fluid is drained, close air bleed valve; reinstall drain plug and lock-wire.

(8) Place fluid container under control module.

R (9) Remove hydraulic tube fittings from control module (Ref. Fig. 401). Place protective caps and plugs on disconnected tubes and fittings.

(10) Disconnect electrical connector from pressure switch.

(11) Disconnect electrical connector from solenoid valve.

R (12) Remove control module mounting bolts and remove module from aircraft.

B. Installation

(1) Verify that circuit breakers opened and tagged in Step 3A(2) are open and tagged.

(2) Place control module in position in aircraft and install mounting bolts.

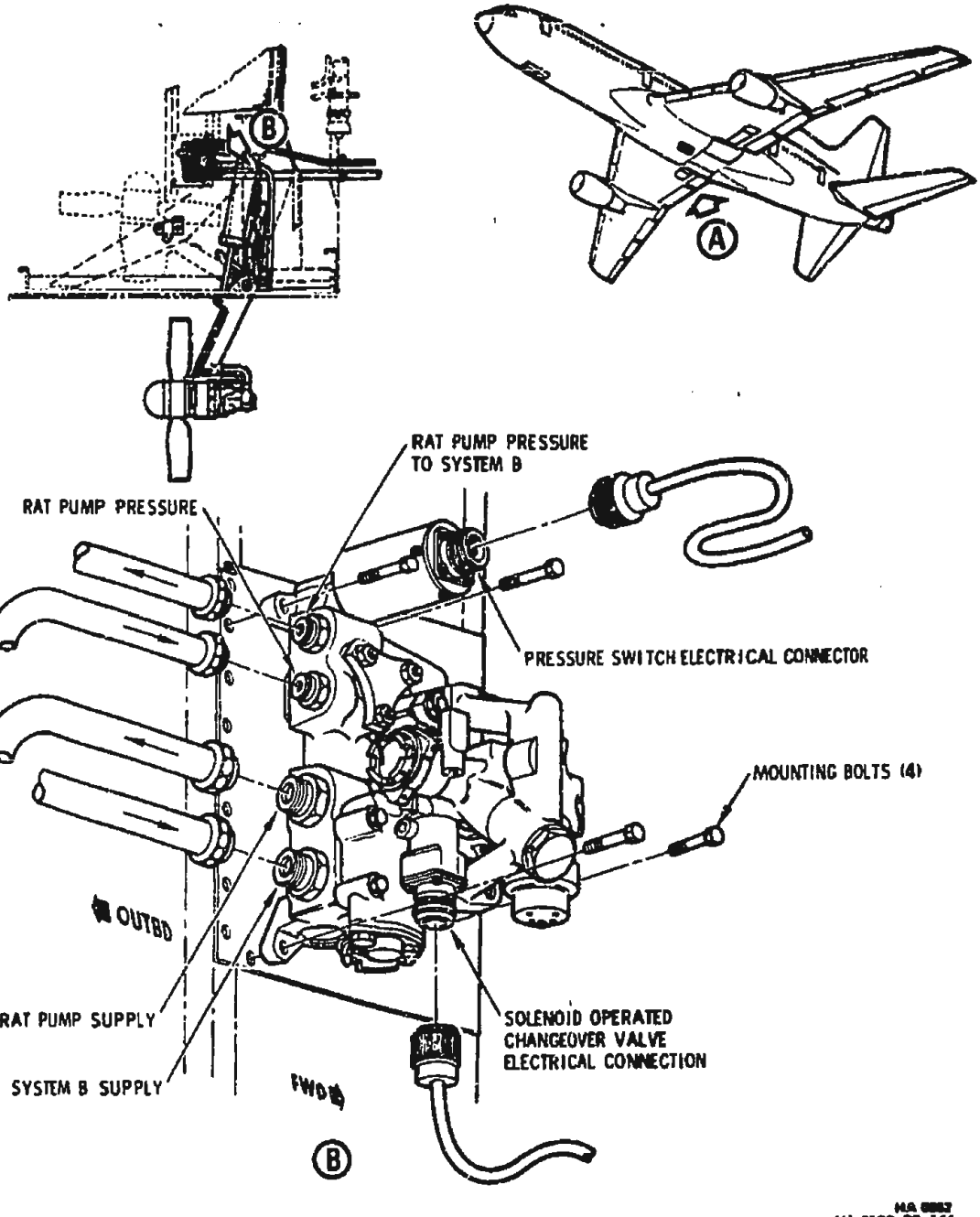
(3) Remove caps and plugs from tube and module fittings and connect hydraulic tubes to control module.

(4) Connect aircraft harness electrical connectors to control module pressure switch and solenoid valve.

(5) Verify that system B reservoir drain plug is installed and lock-wired.

(6) Replenish system B reservoir with hydraulic fluid (Ref. 12-13-00).

R (7) Pressurize hydraulic system B and check hydraulic
R fittings and RAT control module for leakage (Ref.
R 29-11-00).



R Ram Air Turbine Control Module - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
050B

R (8) Perform air bleed check of system B reservoir in
R accordance with instructions on RESERVOIR SERVICING
R placard.

R (9) Perform Spin-up Test (Ref. 29-21-00, Adjustment and Test, Para. 4C).

R (10) Remove plastic cap and reconnect electrical connector on uplock squib actuator.

R (11) Remove tags and close circuit breakers opened in Step 3A(2).

RAM AIR TURBINE HYDRAULIC PUMP - REMOVAL AND INSTALLATION

1. Equipment and Materials

Hydraulic Fluid Container, 3-gallon plastic pail, or equivalent

LAC Spec C34-1224, or equivalent

Hydraulic Fluid,Protective caps and plugs

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

O-ring, Pump Mounting, 7500700AC (1 each)

O-ring, Banjo Bolt HP, 750070710 (2 each)

O-ring, Banjo Bolt LP, 750070712 (2 each)

O-ring, Pressure tube, 750070112 (1 each)

O-ring, Suction tube, 750070114 (1 each)

Flight Line Test Actuator and Deactuator Target Set, EDC Model 8-005101-01, or equivalent

2. Referenced Procedures

12-13-00 Hydraulic Fluid Replenishing - Servicing

29-21-00 Ram Air Turbine System - Adjustment and Test

3. Removal/Installation

A. Removal (Ref. Fig. 401)

(1) Disconnect electrical connector from ram air turbine (RAT) uplock squib actuator. Cover receptacle with plastic cap.

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker RAT MAN DEPLOY (B14) and IND LT RAT (H10).

(3) Deploy RAT as follows:

(a) On pilots overhead circuit breaker panel CB1, verify that circuit breaker RAT AUTO DEPLOY (L3) is closed.

(b) Turn on electrical power (Ref. 24-41-00).

(c) Open hydraulic service center access doors 147AB and 147BB.

NOTE: If the aircraft is on jacks, simulate an on-ground condition at NLG and left MLG proximity sensors by using appropriate targets.

(d) Remove ram air turbine ground safety lock from RAT doors.

R WARNING: BEFORE DEPLOYING RAT TAKE EXTREME PRECAUTION TO ENSURE THAT THE RAT DOOR AND TRAVEL AREA IS CLEAR OF PERSONNEL AND EQUIPMENT. RAT DEPLOYMENT IS EXPLOSIVELY FAST. DO NOT STAND DIRECTLY AFT OF RAT WHILE ACTUATING SWITCH.

(e) On ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, zone 147, lift switch guard and position switch to DEPLOY.

(f) Turn off electrical power (Ref. 24-41-00).

(4) On pilots overhead circuit breaker panel C81, open and tag circuit breaker RAT AUTO DEPLOY (L3).

(5) Verify that hydraulic system B is shut off (Ref. 29-11-00).

(6) Tag Flight Enginner/Second Officers HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147.

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
R LINES OR COMPONENTS. VERIFY ZERO PSI ON HYDRAULIC
R PRESSURE GAGE ON HYDRAULIC SERVICE PANEL.

(7) Depressurize system B reservoir by actuating reservoir
R depressurization valve at base of reservoir.

(8) Drain system B reservoir as follows:

(a) Place fluid container under drain plug.

(b) Remove drain plug.

(c) Open air bleed valve at bottom of reservoir pressurization piston.

(d) When fluid is drained, close air bleed valve; reinstall drain plug and lock-wire.

(9) Place fluid container under RAT hydraulic pump tube connectors (Ref. Fig. 401).

(10) Remove banjo-bolts from pump fittings; discard O-rings.

(11) Loosen sleeve nuts at support leg and remove tubes; discard O-rings. Retain shim washers on tubes.

(12) Remove nuts from pump mounting studs; support pump in horizontal position and pull away from quill shaft.

(13) Place protective caps and plugs on all open lines and ports.

B. Installation (Ref. Fig. 401)

(1) Verify that pump and mounting area are clean.

(2) Place new O-ring in groove on mounting pad of support leg (lubricate with hydraulic fluid).

R CAUTION: VERIFY THAT THE PUMP QUILL SHAFT IS IN MESH WITH THE RAT AND REMAINS IN MESH DURING PUMP INSTALLATION. ALSO VERIFY THAT THE MATING FACES OF THE PUMP FLANGE AND RAT MOUNTING FLANGE MEET WITHOUT STRAIN ON THE PUMP.

(3) Mesh the quill shaft with pump drive shaft serrations; rotate as necessary and install on studs.

(4) Install pump attaching locknuts and torque to 190 lb in.

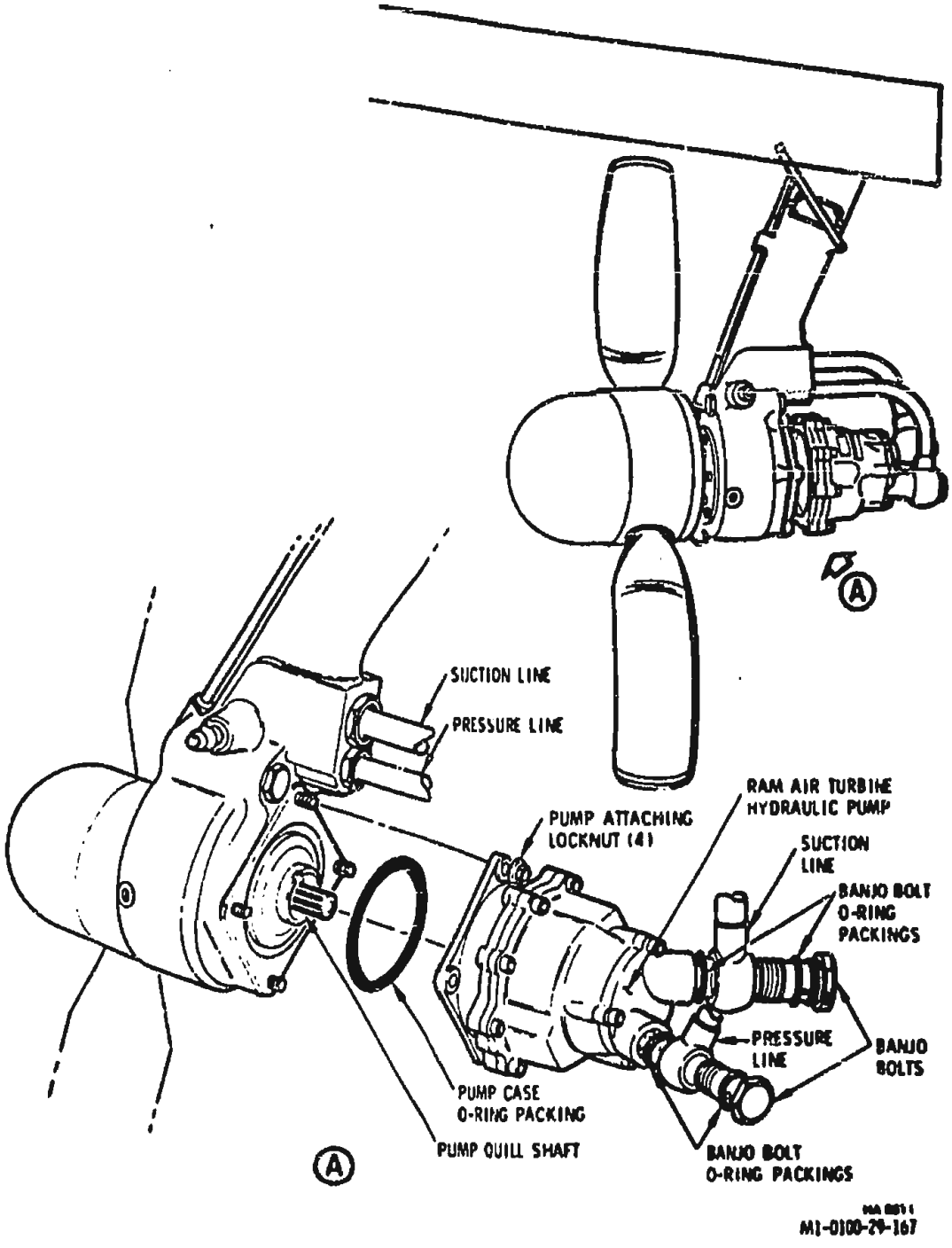
(5) Place new O-rings on pump-to-support leg suction and pressure lines with spiral ring on either side of O-ring (lubricate with hydraulic fluid).

(6) Insert tubes into support leg ports and start sleeve nuts; tighten finger-tight only.

(7) Place new O-rings on banjo-bolts (one on each side of tube) and screw into pump ports finger-tight only.

(8) Tighten each tube assembly sleeve nut and banjo-bolt, alternately, checking that the tube is not binding in any direction.

(a) Tighten sleeve nuts at support leg as follows:



R Ram Air Turbine Hydraulic Pump - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
050B

Suction line, 30 to 35 lb ft.

Pressure line, 48 to 50 lb ft.

(b) Tighten banjo-bolts at pump 18 to 22 lb ft.

(9) Lock-wire sleeve nuts and banjo-bolts.

(10) Verify that system B reservoir drain plug is installed and lock-wired.

(11) Replenish system B hydraulic reservoir (Ref. 12-13-00).

(12) Perform Spin-up Test (Ref. Para. 3C, 29-21-00, Adjustment and Test).

(a) During spin-up test, check pump and fittings for leakage.

(13) Remove tags and close circuit breakers opened in Step 3A(2), 3A(4).

(14) (Remove plastic cap and reconnect electrical connector to uplock squib actuator.

(15) Verify system B hydraulic fluid level is as required; replenish if necessary (Ref. 12-13-00).

R HYDRAULIC CYLINDRICAL ACCUMULATOR (RAT) - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Hydraulic Fluid LAC Spec C-34-1224, or equivalent

R Packing Seal (o-ring) NAS1612-6, -8

R Fluid Container, 3-gallon plastic pail or equivalent

R 2. Referenced Procedures

R	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
R	12-14-16	Hydraulic Reservoir Auxiliary - Pressurization Accumulator Charging
R	24-41-00	External Power/Ground Servicing System - Maintenance Practices
R	29-11-00	Hydraulic Power Systems - Maintenance Practices

R 3. Removal/Installation

R A. Removal

R WARNING: PRIOR TO MAINTENANCE PROCEDURES IN OR NEAR HYDRAULIC SERVICE CENTER, VERIFY THAT THE RAM AIR TURBINE (RAT) GROUND SAFETY LOCK IS INSTALLED OVER THE RAT DOORS.

R CAUTION: OBSERVE WARNING AND CAUTION INSTRUCTIONS FOR HYDRAULIC FLUID HANDLING, REFERENCE MAINTENANCE MANUAL 29-00-00, MAINTENANCE PRACTICES.

R NOTE: Observe standard practices to prevent contamination of hydraulic system fluid during modification operation. Use protective caps on opened lines and component fittings to be reinstalled or reconnected in the hydraulic system.

R (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag the following circuit breakers:

R ATM PUMP - CONT & IND - SYS B (L13)

R PTU - CONT & IND - SYS B-A (L14)

PTU - CONT & IND - SYS C-D (L15)

ATM PUMP - CONT & IND - SYS C (L19)

RUDDER FUSING SYS (L16)

AC PUMP - B3 (L12)

AC PUMP - C3 (L22)

(2) Open hydraulic service center access doors 147AB and 147BB.

(3) Ensure that all hydraulic systems are shut off, (Ref. 29-11-00); tag HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147, to prevent pressurization of any system during modification.

R (4) Prior to opening any plumbing line, actuate reservoir depressurization valve at base of system applicable reservoir until SYS RESERVOIR PRESSURE gage on HYDRAULIC SERVICE PANEL indicates zero psi (ensure that
R the depressurization valve returns fully to normal
R position (pressurized) when released).

NOTE: Use plastic bucket or other suitable container to catch fluid when lines are opened.

(5) At the applicable system accumulator, remove dust cap from charging valve (Ref. Fig. 401).

WARNING: USE CAUTION WHEN BLEEDING OFF AIR CHARGE FROM ACCUMULATOR. HYDRAULIC FLUID MAY BE PRESENT. COVER CHARGING VALVE WITH A CLOTH TO CONTAIN POSSIBLE FLUID SPRAY.

(6) Remove air/nitrogen charge from accumulator by depressing charging valve stem.

(7) Disconnect pressure gage line connector from bottom part of accumulator.

(8) Disconnect hydraulic line connector from adapter at top of accumulator. Install protective caps and plugs on ports and fittings.

(9) Remove screws, nuts and washers from mounting clamps and remove accumulator from bracket. Retain for reinstallation.

(10) Remove adapter (expander) from hydraulic port and discard packing (o-ring).

R (11) Remove air charging valve from side port at lower end
R of accumulator and discard packing (o-ring).

R B. Installation

R (1) Verify that circuit breakers opened and tagged in Step
R 3A(1) are as required.

R (2) Verify that control panel tags installed in Step 3A(3)
R to prevent system pressurization are in place.

R (3) Install packing seal o-rings on the air-change valve
R and the two adapter (expander) fittings. Lubricate
R o-rings with hydraulic fluid.

R (4) Prior to accumulator installation, pour approximately 8
R oz (1/2 pint) of clean hydraulic fluid into each port
R of the accumulator and rotate to thoroughly wet the
R interior and then drain all fluid out.

R (5) Install air-charging valve in side port of the gas cap
R end and tighten.

R (6) Install adapter fittings in the hydraulic and gas cap
R ports.

R (7) Position mounting clamps in place and mount accumulator
R to mounting bracket using screws, nuts and washers
R retained during removal [Step 3A(9)].

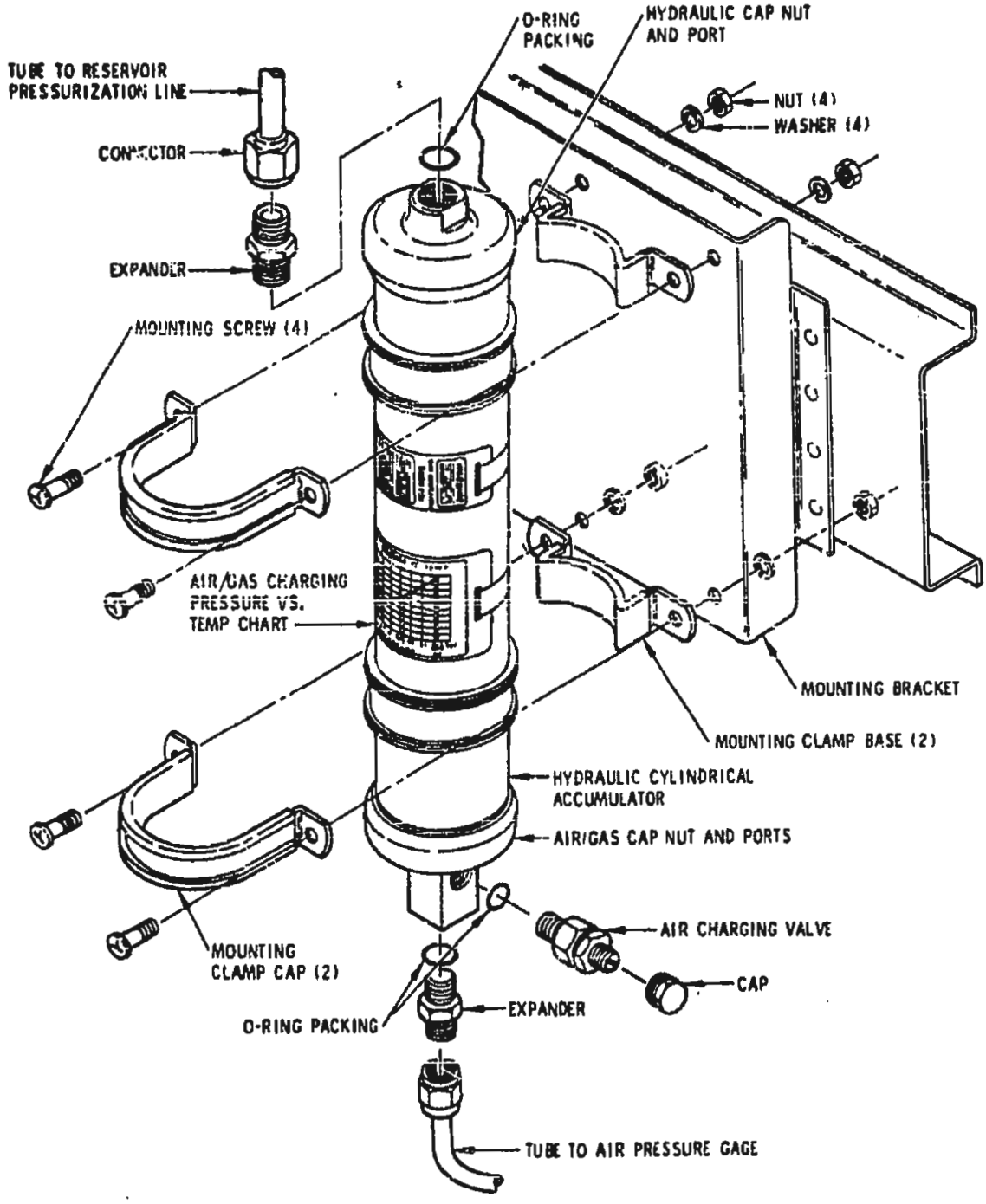
R (8) Verify that air-charging valve and servicing gas
R precharge pressure versus temperature chart are in
R accessible position then tighten the four mounting
R screws and nuts.

R (9) Remove protective plugs from hydraulic and air pressure
R gage line connectors, and connect to accumulator
R adapter fittings.

R (10) Perform air/nitrogen servicing of the accumulator (Ref.
R 12-14-16).

R (11) Bleed system of air as follows:

R (a) Verify that the applicable system reservoir fluid
R level is as required, replenish if necessary (Ref.
R 12-13-01).



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R Hydraulic Cylindrical Accumulator - Removal and Installation
R Figure 401

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(b) Pressurize the applicable system and check fittings for leakage; shut off hydraulic power source.

R (c) Actuate reservoir depressurization valve until applicable SYSTEM and RESERVOIR PRESSURE gages on the HYDRAULIC SERVICE PANEL, zone 147, indicate zero psi.

(d) Repeat steps (b) and (c) three times and perform RESERVOIR AIR CHECK in accordance with instructions on RESERVOIR SERVICING INSTRUCTIONS placard (Ref. 12-13-01).

(12) Turn off hydraulic power (Ref. 29-11-00).

(13) Turn off electrical power (24-41-00).

(14) Close and lock hydraulic service center access doors.

R RAM_AIR_TURBINE_MANIFOLDED_RESERVOIR_CHECK_VALVE_MODULE

R 1. Equipment_and_Materials

R Fluid Container gallon plastic pail, or equivalent

R Hydraulic Fluid LAC Spec C34-1224, or equivalent

R Protective caps and plugs

R O-Ring Gaskets

R 2. Referenced_Procedures

R 12-13-00 Hydraulic Fluid Replenishing - Servicing

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 29-21-00 Ram Air Turbine System - Adjustment and Test

R 3. Removal/Installation

R WARNING: DEPRESSURIZE ACCUMULATORS BEFORE LOOSENING ANY
R HYDRAULIC LINES. VERIFY ZERO PSI AT RESERVOIR
R PRESSURE GAGE ON HYDRAULIC SERVICE PANEL (REF.
R 29-11-00).

R A. Removal

R (1) Open hydraulic service center access doors 147AB and
R 147BB.

R (2) Verify that system B hydraulic system is shut off (Ref.
R 29-11-00).

R (3) Tag Flight Engineers/Second Officers HYDRAULIC SYSTEM
R PANEL, zone 215, and HYDRAULIC SERVICE PANEL, zone 147.

R (4) Depressurize system B reservoir by actuating reservoir
R depressurization valve at base of reservoir. Verify
R zero psi at B SYS RESERVOIR PRESSURE gage on HYDRAULIC
R SERVICE PANEL.

R (5) Place fluid container under check valve module.

R (6) Remove hydraulic tube fittings from check valve module.
R Place protective caps and plugs on disconnected tubes
R and fittings (Ref. Fig. 401).

R (7) Remove union fittings from module and discard old
R o-ring gaskets.

R (8) Remove control module mounting bolts and remove module.

R B. Installation

R (1) Reinstall union fittings in module using new o-ring
R gaskets.

R (2) Place check valve module in position and install
R mounting bolts.

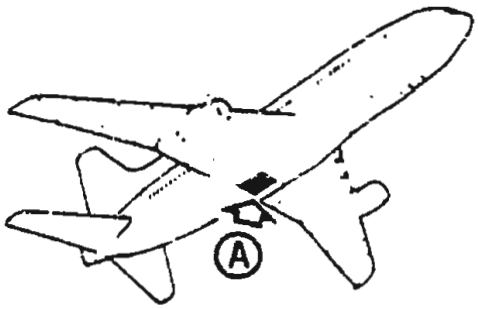
R (3) Remove plugs and reconnect hydraulic lines to module.

R (4) Replenish system B reservoir with hydraulic fluid (Ref.
R 12-13-00).

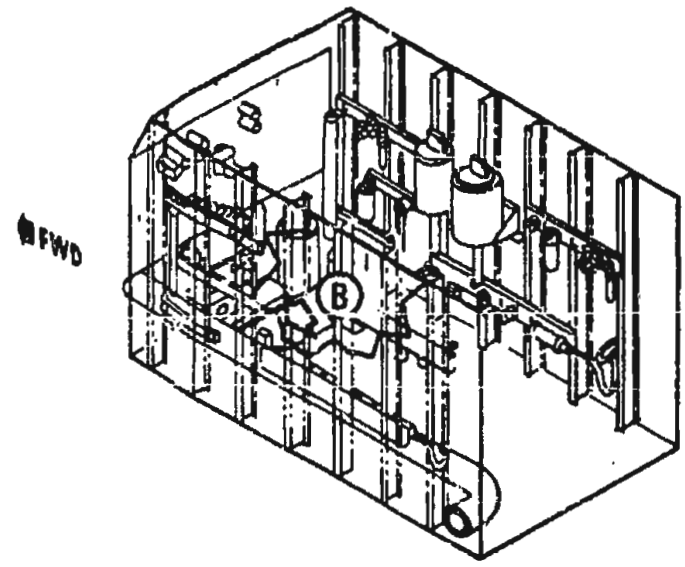
R (5) Pressurize hydraulic system B and check hydraulic
R fittings and check valve module for leakage (Ref.
R 29-11-00).

R (6) Perform air bleed check of system B reservoir in
R accordance with instructions on RESERVOIR SERVICING
R placard.

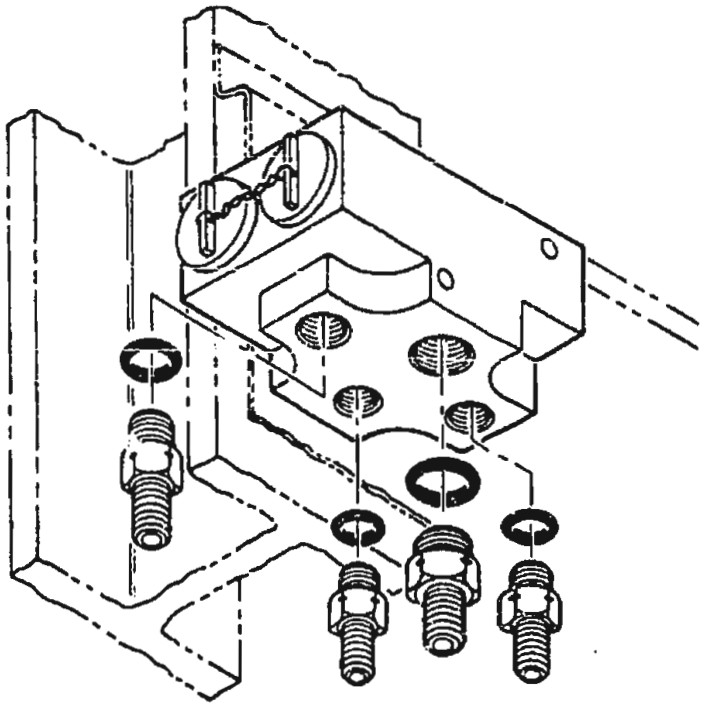
R (7) Perform RAT Spin-up Test (Ref. 29-21-00).



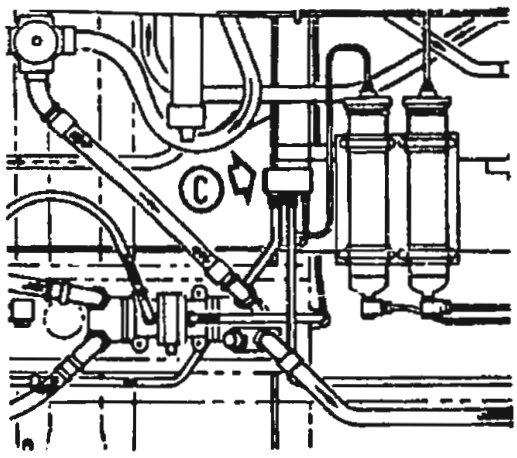
ZONE 147



(A)
HYDRAULIC SERVICE CENTER



(C)
MANIFOLD CHECK VALVE



(B)
VIEW LOOKING OUTBOARD
LEFT SIDE OF HYDRAULIC SERVICE CENTER

MI-0000-29-398

R Ram Air Turbine Manifolded Reservoir Check Valve - Removal and
R Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

R SQUIB TRIGGER ASSEMBLY - REMOVAL AND INSTALLATION

R 1. Safety Precautions

R A. This device has an explosive charge which in the event of
R operation, either accidentally or normally, is completely
R contained within the unit. There is only one moving part,
R the ram, which protrudes from the flange end. The ram moves
R forward approximately 0.4 inch upon actuation. Observe the
R following safety precautions at all times:

R (1) The red anodized guard assembled on the trigger
R assembly, is primarily intended to prevent a possible
R (although not probable) missile-like ejection of the
R ram in the event of an inadvertent firing of the
R trigger assembly. Remove red anodized guard
R immediately prior to installation of trigger assembly
R into the system.

R (2) When handling the trigger assembly without the guard,
R always point the ram protrusion end away from the body
R or any other person in the vicinity.

R (3) The unit is supplied with an R.F. shield over the
R electrical connector to prevent accidental discharge
R through pick-up of an induced current and/or
R application of a potential difference by contact with
R the connector pins. Remove R.F. shield just prior to
R installation of the mating connector following
R installation of the trigger assembly into the system.

R (4) When handling the trigger assembly, always ground the
R unit by grasping the body of the trigger assembly
R firmly with one hand. The R.F. shield can then be
R removed and contact made with the connector pins.

R (5) Observe all standard precautions against build-up and
R discharge of a static charge. These include the
R wearing of clothing consisting of cotton and leather
R only, and handling in an area where all points of
R contact with the primer chamber assembly are at ground
R potential.

R (6) Unit is operated through application of current through
R connector pins.

R 2. Equipment and Materials

R Sealant, LCM40-2180 Type II, or equivalent

R 3. Referenced Procedure

R 29-21-00 Ram Air Turbine - Adjustment and Test

R 4. Removal/Installation

R A. Removal

R (1) On pilots overhead circuit breaker panel CB1, zone 210, R open and tag circuit breaker RAT MAN DEPLOY (B14).

R (2) Open hydraulic service center access door 147AB.

R (3) On upper aft end of ram air turbine uplock, disconnect R electrical connector from squib trigger assembly. If R squib has not been discharged, place plastic cap over R receptacle.

R (4) Remove squib trigger mounting screws and remove squib R from uplock assembly. Observe safety precautions R listed in Paragraph 1 if squib has not been discharged.

R B. Installation

R (1) Observe safety precautions in Paragraph 1.

R (2) Verify that circuit breaker opened and tagged in Step R 4A(1) is open and tagged.

R (3) Remove red anodized guard from squib trigger assembly.

R (4) Apply sealant to faying surface of uplock assembly and R squib trigger.

R (5) Position trigger assembly on uplock with electrical R receptacle facing aft.

R (6) Install four mounting screws and tighten.

R (7) Remove plastic protective cap from squib trigger R receptacle and attach electrical connector.

R (8) Close circuit breaker opened in Step 4A(1).

R (9) Perform adjustment and test procedures (Ref. 29-21-00).

R (10) Close and lock hydraulic service center access door R 147AB.

RAM AIR TURBINE HYDRAULIC FILTER - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-13-00	Hydraulic Fluid Replenishing - Servicing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-10	Ram Air Turbine - Maintenance Practices

2. Removal/Installation

A. Removal

R (1) Open and tag following circuit breakers:

R R (a) On pilots overhead circuit breaker panel CB1, zone 210, RAT MAN DEPLOY (B14).

R R (b) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, IND LT RAT (G10).

R (2) Disconnect electrical connector from ram air turbine (RAT) uplock squib actuator assembly. Cover receptacle with plastic cap.

(3) Deploy RAT as follows:

(a) On pilots overhead circuit breaker panel CB1, verify that circuit breaker RAT AUTO DEPLOY (L3) is closed.

NOTE: If the aircraft is on jacks, simulate an on-ground condition at NLG and left MLG proximity sensors by using appropriate targets.

(b) Turn on electrical power (Ref. 24-41-00).

(c) Open hydraulic service center doors 147AB and 1478B.

(d) Remove ram air turbine ground safety lock from RAT door area.

WARNING: BEFORE DEPLOYING RAT TAKE EXTREME PRECAUTION TO ENSURE THAT THE RAT DOOR AND TRAVEL AREA IS CLEAR OF ALL EQUIPMENT AND PERSONNEL. RAT DEPLOYMENT IS EXPLOSIVELY FAST. DO NOT STAND DIRECTLY AFT OF RAT WHILE ACTUATING SWITCH.

(e) On ram air turbine GROUND TEST panel below HYDRAULIC SERVICE PANEL, zone 147, lift guard and position switch to DEPLOY.

(f) Turn off electrical power (Ref. 24-41-00).

(4) On pilots overhead circuit breaker panel CB1, open and tag circuit breaker RAT AUTO DEPLOY (L3).

(5) Verify that system B hydraulic system is shut off (Ref. 29-11-00).

(6) Place tags on Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and on the HYDRAULIC SERVICE PANEL, zone 147.

R (7) Depressurize system B reservoir and accumulator (Ref. R 29-11-00). Verify zero psi at B SYS RESERVOIR PRESSURE R gage on HYDRAULIC SERVICE PANEL.

R CAUTION: DEPRESSURIZE APPLICABLE HYDRAULIC SYSTEM R ACCUMULATORS BEFORE REMOVING FILTER PLUG OR OTHER R HYDRAULIC COMPONENTS. VERIFY ZERO PSI ON PRESSURE R GAGE ON HYDRAULIC SERVICE PANEL WITH R DEPRESSURIZATION VALVE IN NORMAL POSITION.

R (8) Cut lockwire and remove filter plug (Ref. Fig. 401).

(9) Remove and discard O-ring seal (4) from plug.

(10) Remove shim (5) and retain.

(11) Remove filter (6) and O-ring (7).

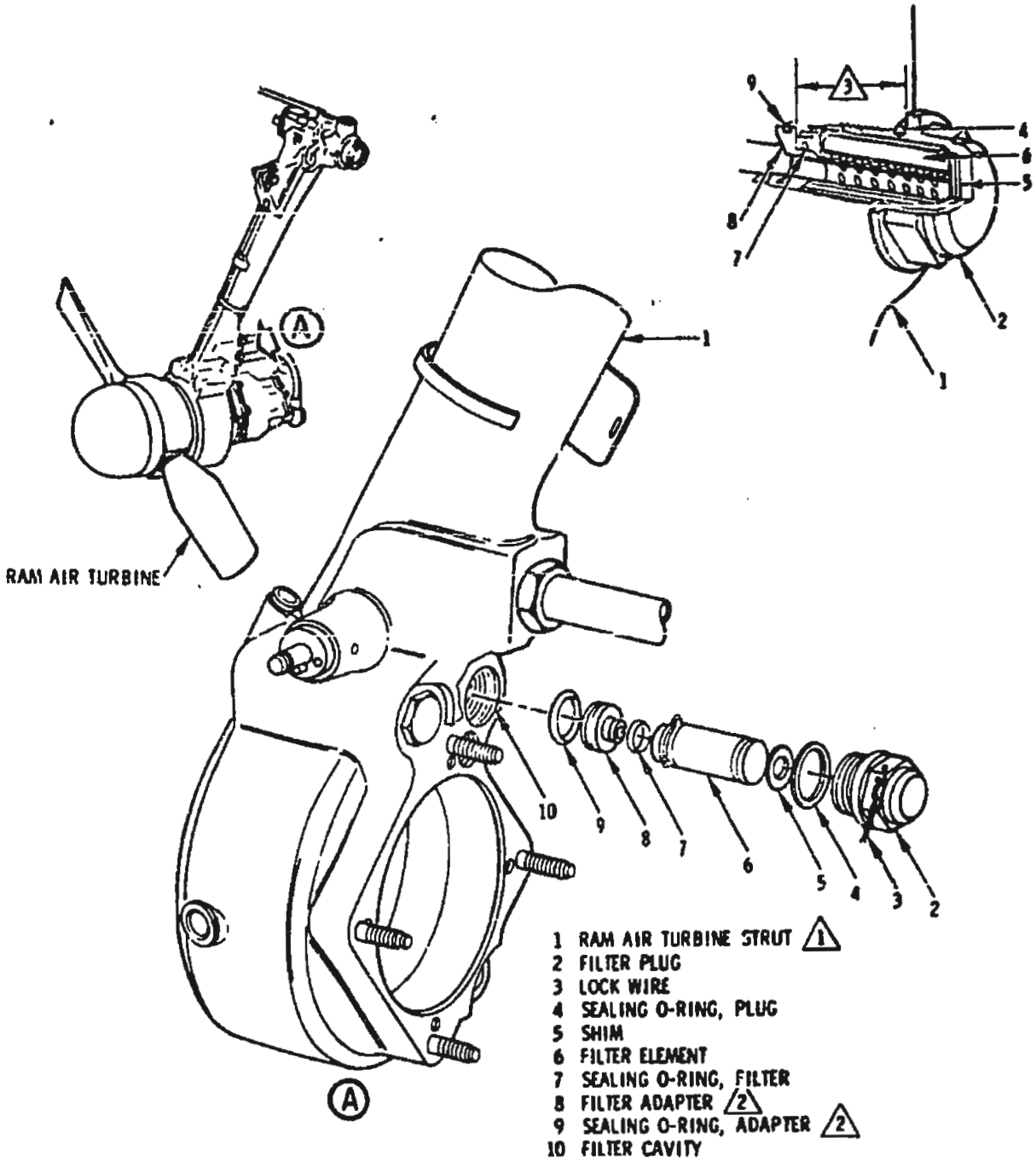
(12) Filter adapter (8) with O-ring (9) may be left in place.

B. Installation

(1) Check filter cavity (10) for cleanness and flush with hydraulic fluid if necessary.

NOTE: Do not use a cleaning solvent.

(2) Place shim (5) into cavity of filter plug (2). Insert new filter element into plug cavity to abut shims.



1 RAM AIR TURBINE STRUT (1)
2 FILTER PLUG
3 LOCK WIRE
4 SEALING O-RING, PLUG
5 SHIM
6 FILTER ELEMENT
7 SEALING O-RING, FILTER
8 FILTER ADAPTER (2)
9 SEALING O-RING, ADAPTER (2)
10 FILTER CAVITY

NOTE

(1) HYDRAULIC PUMP AND PROPELLER ASSEMBLIES REMOVED FOR CLARITY
(2) MAY BE LEFT IN PLACE
(3) 1.250 TO 1.255 INCH FROM BUTT SURFACE OF FILTER PLUG (2) TO END OF FILTER ELEMENT

M1-0101-29-382

R Ram Air Turbine Hydraulic Filter - Removal and Installation
R Figure 401

NOTE: When fitting a replacement filter element manufactured by Aircraft Porous Media Ltd., the separate coil spring which is included in the pack is not needed in this application and should be discarded.

(3) Measure distance from end face of filter to end of filter plug. Dimension should be 1.250 to 1.255 in. Adjust shim thickness as required.

(4) Install filter O-ring seal (7) into filter element (6).

(5) Wet O-ring seal (7) with clean hydraulic fluid and insert filter element into filter cavity (10) onto filter adapter (8).

(6) Install new O-ring (4) onto filter plug (2) and wet O-ring with clean hydraulic oil.

(7) Dip shims into appropriate hydraulic oil and insert shims (5) into cavity of filter plug (2) and screw plug into filter cavity (10) over filter element (6).

NOTE: Shims are moistened with hydraulic oil to assist retention in correct position during assembly.

(8) Tighten filter plug and torque to 8 to 10 lb ft. and lock-wire.

R (9) Restow RAT (Ref. 29-21-10).

HYDRAULIC INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

The hydraulic indicating system provides the Flight Engineer/Second Officer with a status of the hydraulic system operation. All switchlights, indicator lights, and quantity and pressure indicators are located on the HYDRAULIC SYSTEM control panel, zone 215. Duplicate switches, indicator lights, pressure gages, and a temperature indicator are located on the HYDRAULIC SERVICE PANEL in the hydraulic service center, zone 147. The hydraulic service center panel, which is not accessible in flight, is used for ground maintenance and during ground fault isolation operations.

2. Electric Motor-driven Pump Indicating System

A. Description and Operation

AC PUMPS B3 and C3 ON switchlights on the HYDRAULIC SYSTEM panel, zone 215, come on whenever the applicable remote control circuit breaker (RCCB), zone 137, is energized to provide three-phase power for the electric motor-driven pumps (Ref. Fig. 1 and 29-11-00). The A.C. MOTOR PUMPS control switches on the HYDRAULIC SERVICE PANEL do not contain indicator lights. The toggle switch lever position indicates the ON or OFF position.

3. Power Transfer Unit Control Indicating System

A. Description and Operation

On the HYDRAULIC SYSTEM control panel, zone 215, the hydraulic systems B-A and C-D PTU PWR switchlights (light bar) come on whenever the applicable contacts of the system magnetic latch indicator relay close to complete the dc power to the lamp (Ref. Fig. 2 and 29-11-00). The switchlight (light bar) comes on when the main solenoid of the solenoid shutoff valve is energized. Contacts of the magnetic latch indicator relay light the applicable indicator light on the HYDRAULIC SERVICE PANEL in the hydraulic service center, zone 147.

4. Pump Depressurization Indicating System

A. Description and Operation

The hydraulic pump depressurization switchlight flowbars come on whenever the related hydraulic pump switchlight is depressed to pressurize the hydraulic pump, and the OFF light comes on when the switchlight is released to depressurize the pump (Ref. Fig. 3 and 29-11-00). Each pair of lights (OFF/light bar) are an integral part of the hydraulic pump switchlight that controls the engine-driven hydraulic pump solenoid-operated depressurization valve. The 28V dc powers the switchlights through dc bus No. 1, the indicator lights control box, and dimming bus No. 3 and test bus No. 3.

5. Hydraulic Pressure Indicating System

A. Description and Operation

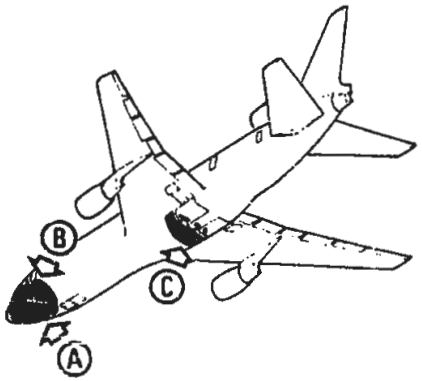
The hydraulic pressure indicating system shows the fluid pressure generated by the hydraulic pumps of the four systems (Ref. Fig. 4 and 5). Each system (A, B, C, and D), includes a hydraulic pressure transmitter in each high-pressure filter module and a hydraulic pressure indicator on the HYDRAULIC SYSTEM control panel, zone 215. Each indicator dial face is graduated from 0 to 4000 psi. The 115V ac bus power goes into each indicator and is reduced to 26V ac to energize the transmitter and indicator circuit. The transmitter is a center-tapped coil to form a balanced bridge circuit when connected to the indicator coils. The hydraulic line pressure actuates a movable slug inside one of the transmitter coils to increase or decrease the coil reluctance value, thereby unbalancing the bridge circuit. The middle leg of the bridge actuates the moving coil with its attached pointer. The dial lights are powered by 5V ac from the Flight Engineer/Second Officers instrument lights dimming unit (Ref. 33-11-00).

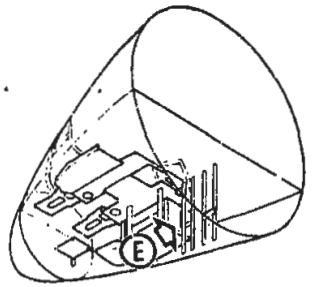
Hydraulic pressure indication on the HYDRAULIC SERVICE PANEL is by direct-reading pressure gages plumbed to the high-pressure filter modules in each of the four systems. Two of the gages on the panel (systems B and C) are dual-needle gages. The second needle indicates the brake accumulator brake pressure available for towing or parking.

6. Reservoir Fluid Quantity and Temperature Indicating System

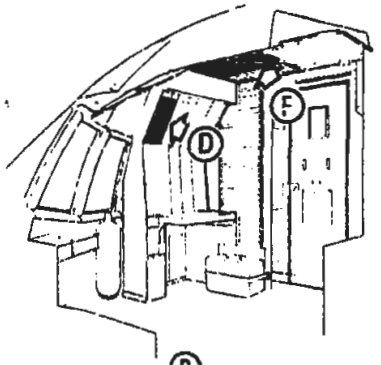
A. Description

The reservoir fluid quantity and temperature indicating system includes the following major components (Ref. Fig. 6):

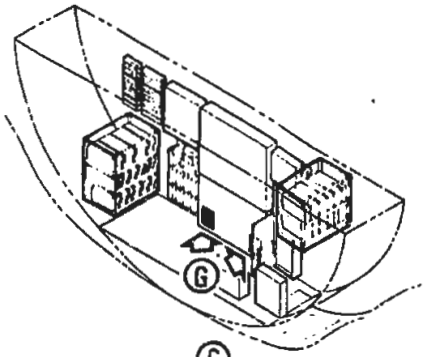




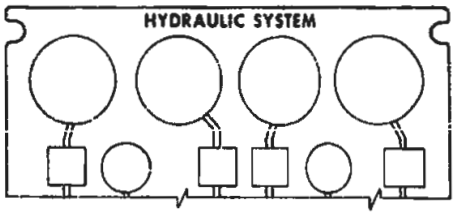
Ⓐ FORWARD ELECTRONIC SERVICE CENTER

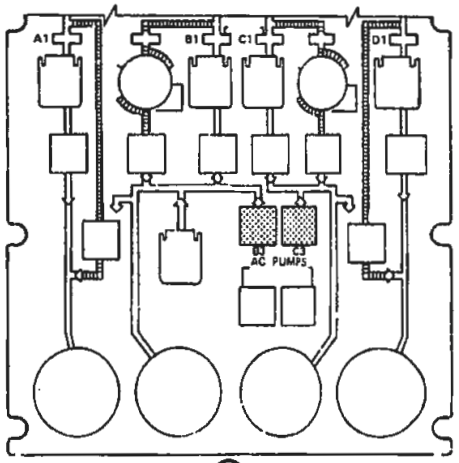


Ⓑ FLIGHT ENGINEER/SECOND OFFICERS STATION

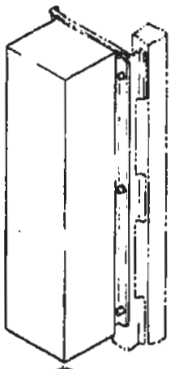


Ⓒ MID ELECTRICAL SERVICE CENTER

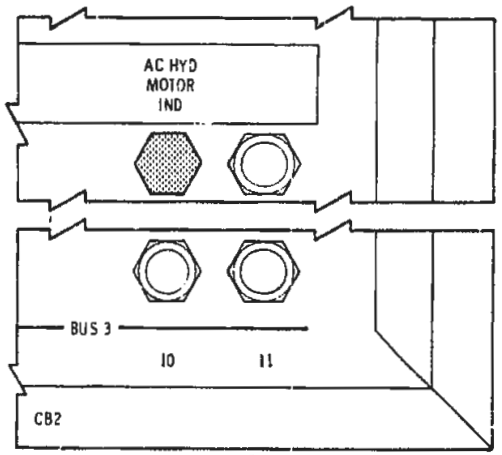




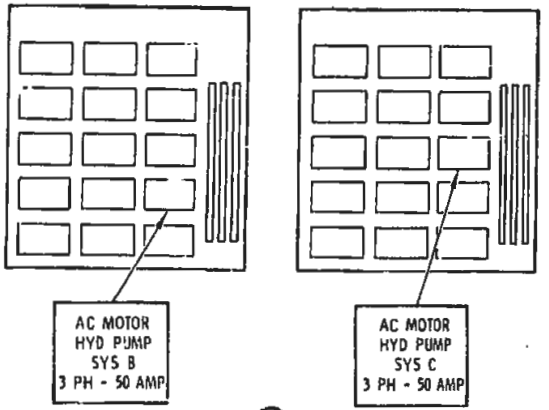
Ⓓ HYDRAULIC SYSTEM CONTROL PANEL



Ⓔ INDICATOR LIGHTS CONTROL BOX



Ⓕ FLIGHT ENGINEER/SECOND OFFICERS OVERHEAD CIRCUIT BREAKER PANEL

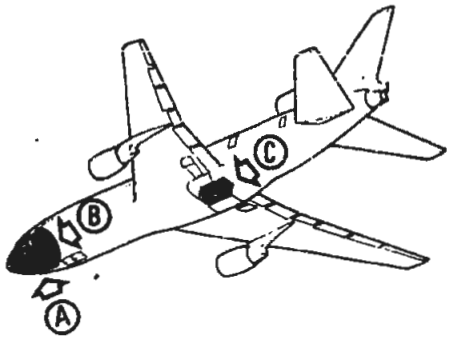


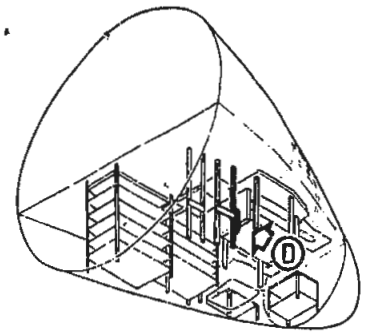
Ⓖ REMOTE CONTROL CIRCUIT BREAKER FOR HYDRAULIC SYSTEMS B & C ELECTRIC MOTOR DRIVEN PUMPS

G 371
M1-0102-29-090

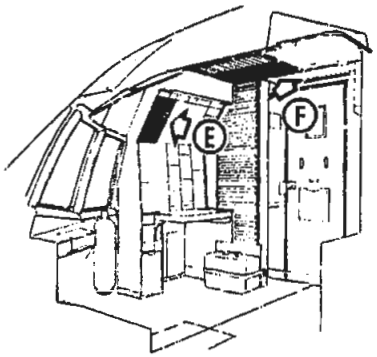
R
R
R

Electric Motor-driven Pump Indicating System
Component Locator
Figure 1

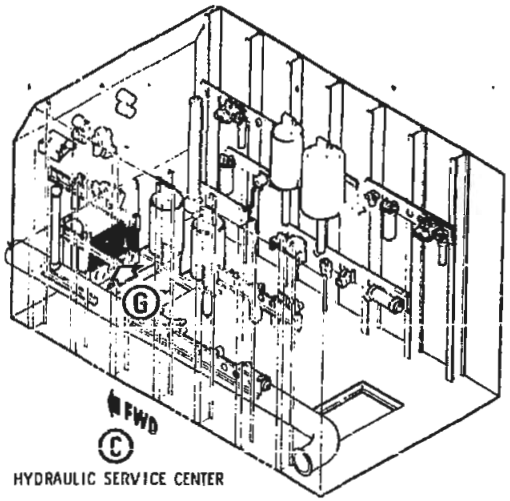




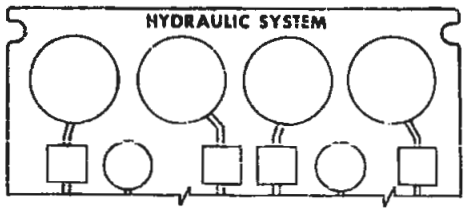
Ⓐ
HYD ELECTRONICS SERVICE CENTER

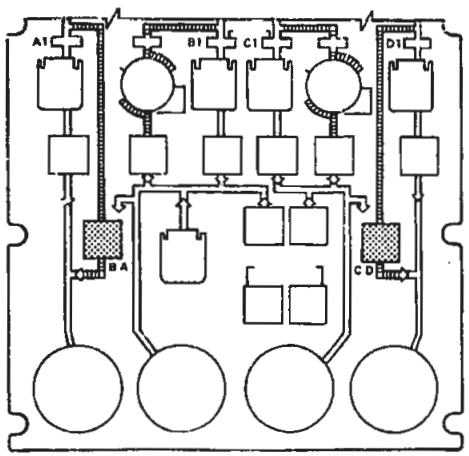


Ⓑ
FLIGHT ENGINEER/SECOND OFFICERS STATION

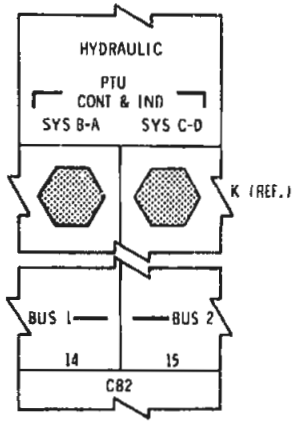


Ⓒ
HYDRAULIC SERVICE CENTER

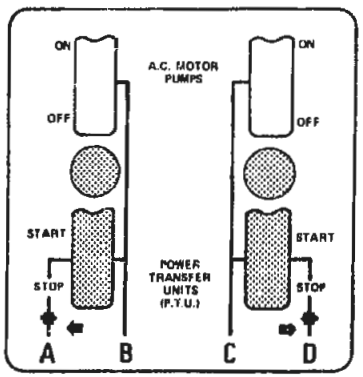




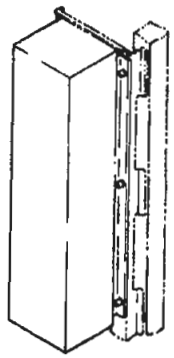
Ⓔ
PTU CONTROL & INDICATORS
HYD SYSTEM CONTROL PANEL



Ⓕ
PTU CIRCUIT BREAKERS
FLIGHT ENGINEER/SECOND OFFICERS
OVERHEAD CIRCUIT BREAKER PANEL



Ⓖ
PTU CONTROL & INDICATOR
HYD SYSTEM SERVICING PANEL



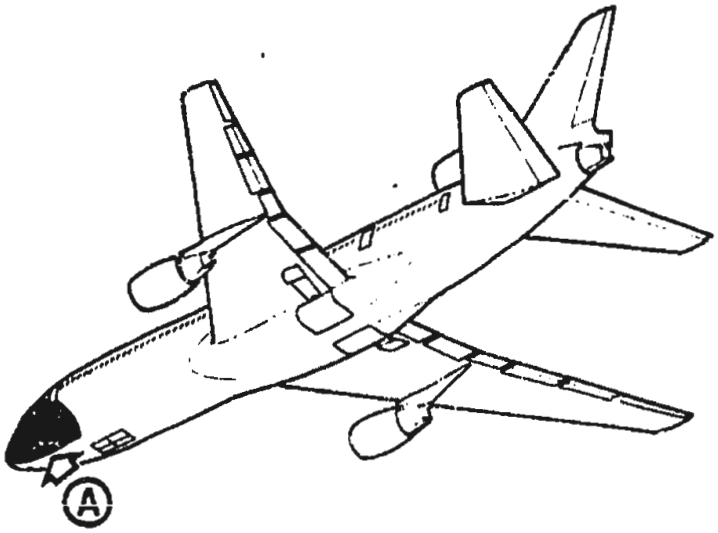
Ⓓ
INDICATOR LIGHTS CONTROL BOX

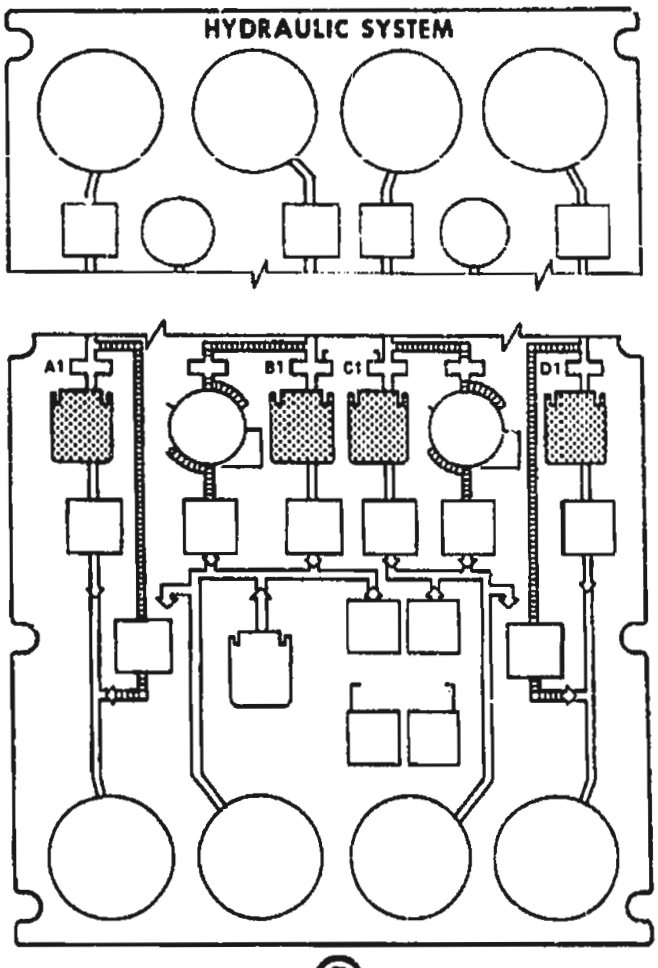
G347
MI-0101-29-091

R Power Transfer Unit Indicating System Component Locator
R Figure 2

EFFECTIVITY: ALL

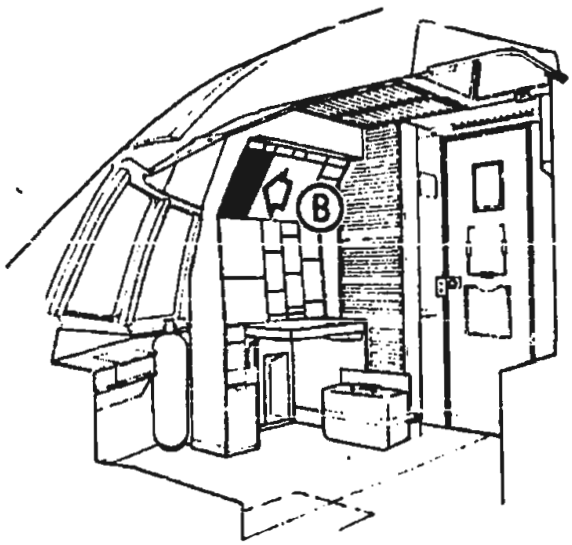
001E





(B)

HYDRAULIC PUMPS DEPRESSURIZATION
CONTROLS AND INDICATORS
HYDRAULIC SYSTEMS CONTROL PANEL



(A)

FLIGHT ENGINEER/SECOND OFFICERS
STATION

HH 6310
M1-0101-29-092

R Engine-driven Hydraulic Pump Indicating System Component Locator
R Figure 3

Four reservoir FLUID QUANTITY indicators on the Flight Engineer/Second Officers HYDRAULIC SYSTEM control panel, zone 215

One RESERVOIR QUANTITY indicator and one RESERVOIR TEMPERATURE indicator, with a RESERVOIR SELECTOR switch on the HYDRAULIC SERVICE PANEL in the hydraulic service center, zone 147

Four combined mechanical-type quantity indicator and transmitter assemblies, one on top of each hydraulic reservoir in the hydraulic service center, zone 147

Four dual-element reservoir fluid temperature sensors, one in the bottom of each hydraulic reservoir

Four temperature compensators mounted on the walls of the hydraulic service center, one near each reservoir

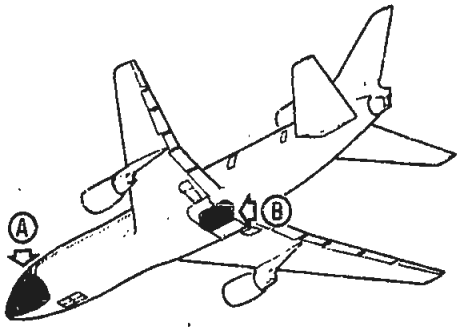
Each combined mechanical-type quantity indicator and transmitter assembly includes a direct-reading quantity indicator and a quantity transmitter. The transmitter signal goes to the temperature compensator for that reservoir, together with the temperature signal from one of the elements of the dual-temperature sensor in that reservoir. The compensator adjusts the quantity signal to correct for the effect of fluid temperature.

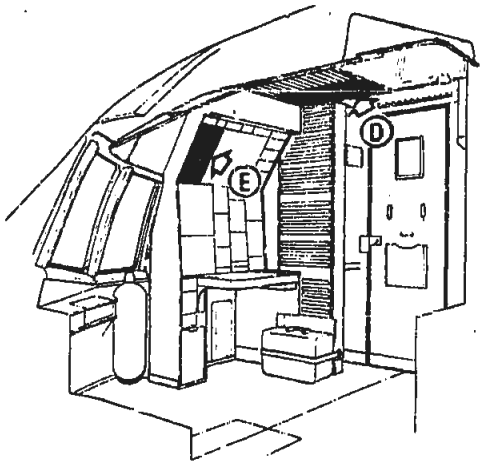
From each of the four temperature compensators, the corrected quantity signals go to the four indicators on the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel and to the selector switch on the HYDRAULIC SERVICE PANEL in the hydraulic service center (Ref. Fig. 7).

The second element in the dual-temperature sensor in each reservoir is connected to the selector switch on the HYDRAULIC SERVICE PANEL. When the RESERVOIR SELECTOR switch is rotated from the OFF position to the A, B, C, or D position, the RESERVOIR QUANTITY and RESERVOIR TEMPERATURE indicators on that panel are connected to read that reservoir quantity and temperature.

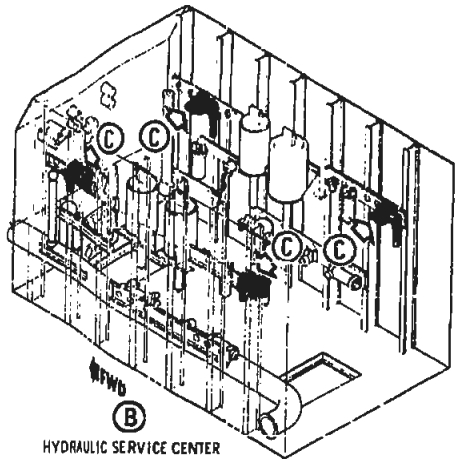
B. Operation

The reservoir fluid quantity indicating system (Ref. Fig. 7) uses 115V ac power to provide the indicating signal from the transmitter through the temperature compensator to the fluid quantity indicator. The 115V ac is reduced to a voltage within the range of 0 to 5V ac in the transmitter. A variable resistor across the transmitter transformer secondary winding is mechanically actuated to vary the voltage input to the temperature compensator. The

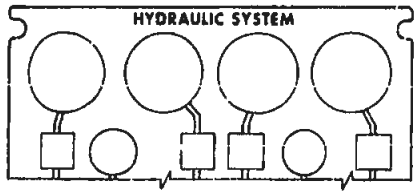


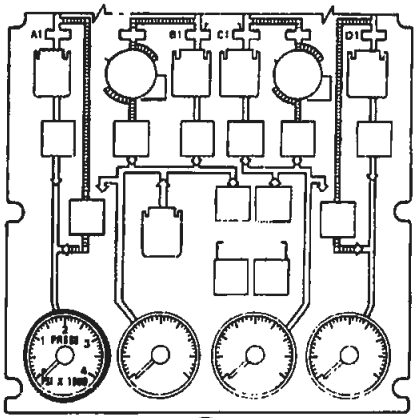


A
FLIGHT ENGINEER/SECOND OFFICERS STATION

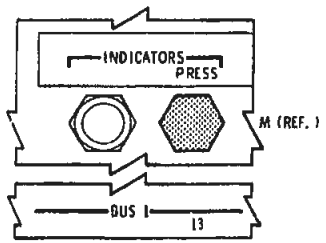


B
HYDRAULIC SERVICE CENTER

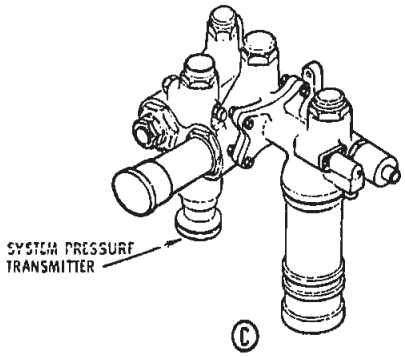




E
HYDRAULIC SYSTEM CONTROL PANEL



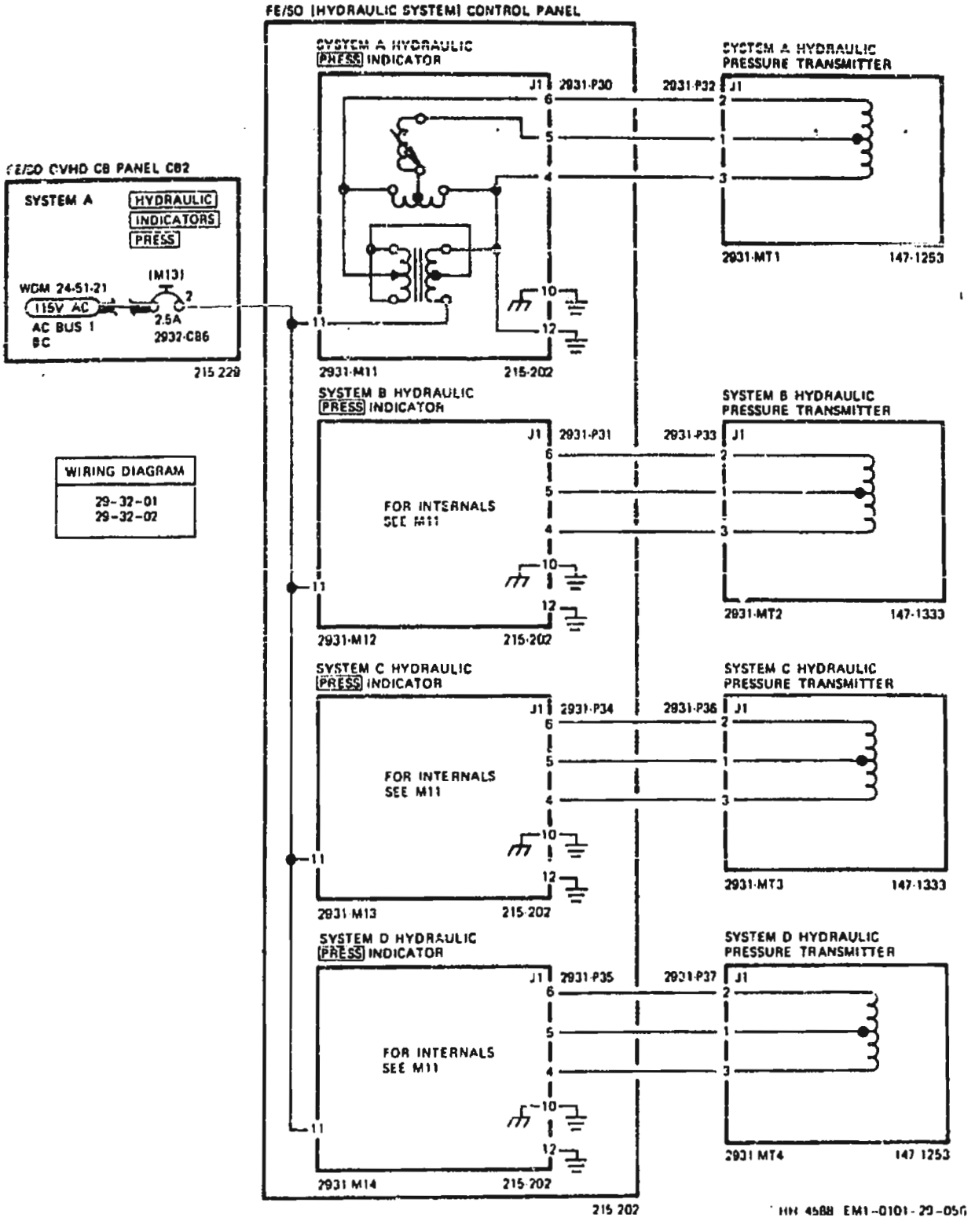
D
FLIGHT ENGINEER/SECOND OFFICERS
OVERHEAD CIRCUIT BREAKER PANEL
CB2



C
HIGH PRESSURE FILTER

G352
M1-0102-29-093

R Hydraulic Pressure Indicating System Component Locator
R Figure 4

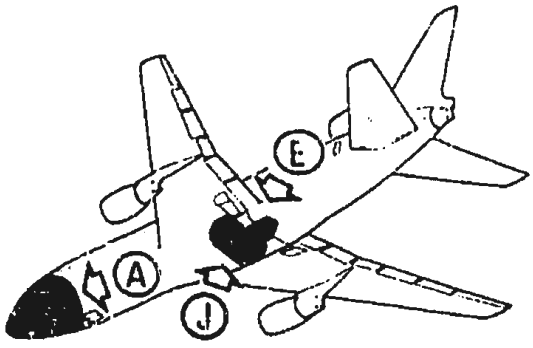


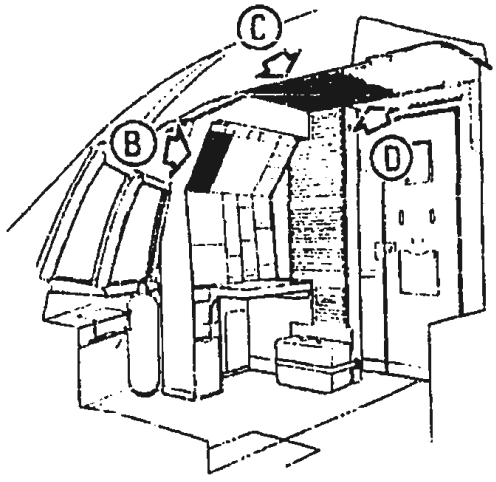
WIRING DIAGRAM

29-32-01
29-32-02

R Hydraulic Pressure Indicating System Schematic
R Figure 5

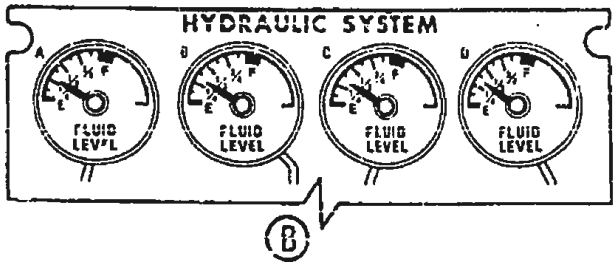
R EFFECTIVITY: ALL



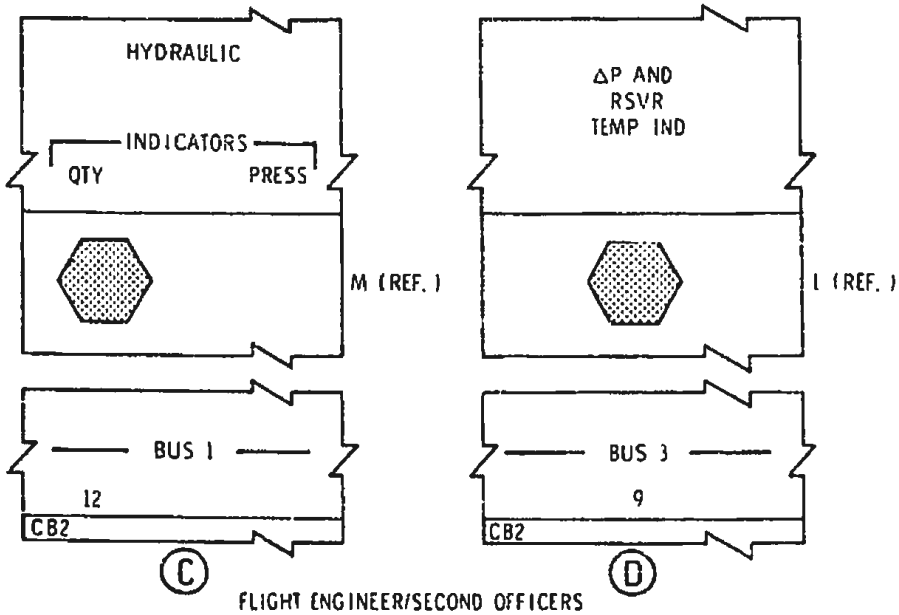


A

FLIGHT ENGINEER/SECOND OFFICERS STATION



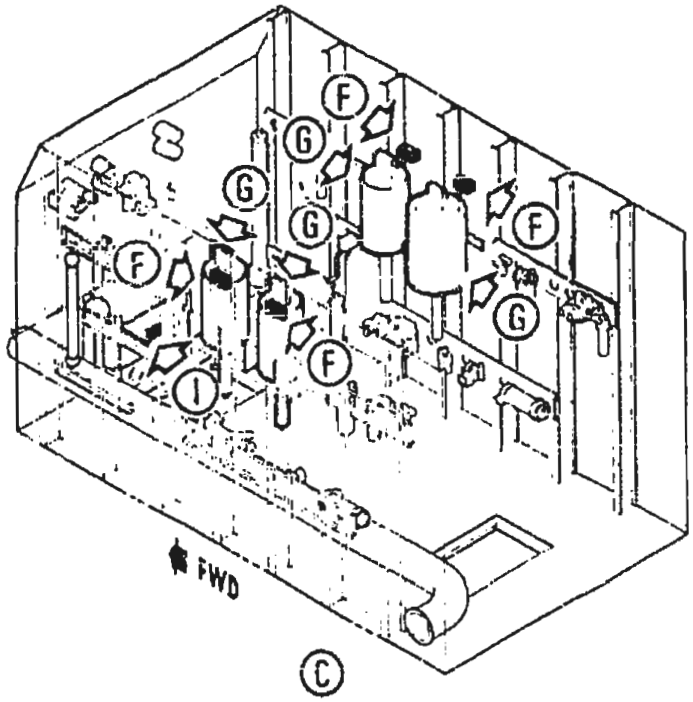
HYDRAULIC SYSTEM CONTROL PANEL
FLUID LEVEL INDICATORS



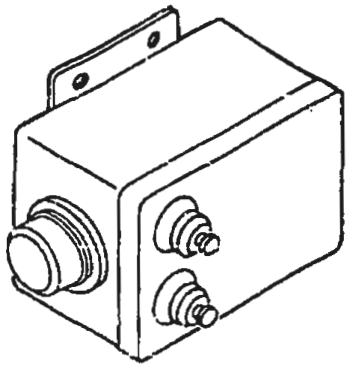
FLIGHT ENGINEER/SECOND OFFICERS OVERHEAD CIRCUIT BREAKER PANEL CB2

HH 6228
M1-0401-29-094

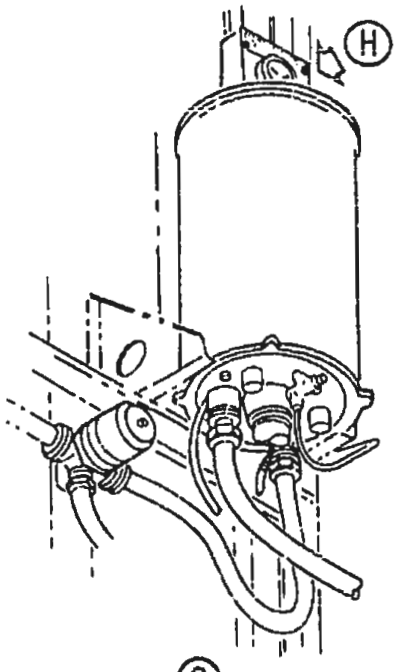
Hydrauiic Fluid Quantity and Temperature Indicating System
Component Locator
Figure 6 (Sheet 1)



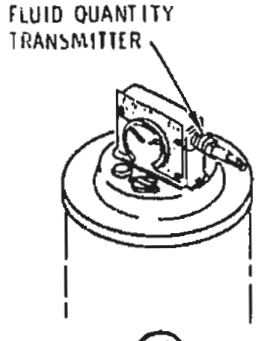
C
HYDRAULIC SERVICE CENTER



F
TEMPERATURE
COMPENSATOR



G
HYDRAULIC RESERVOIR



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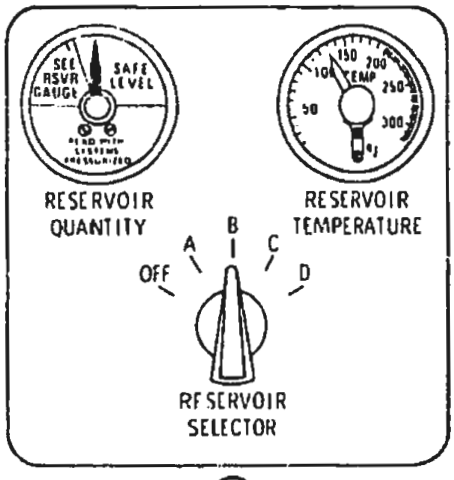
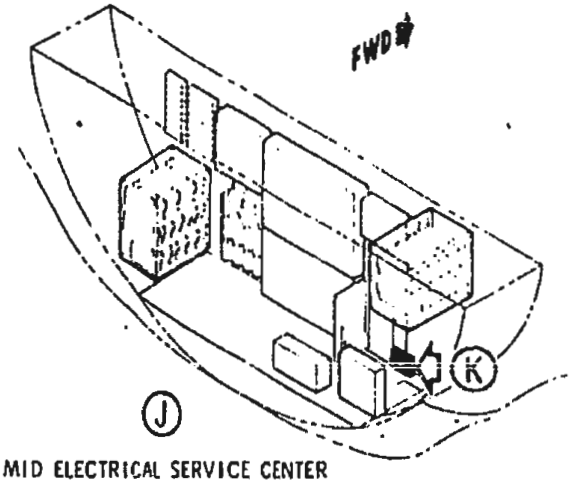


I
HYDRAULIC SERVICE CENTER
HYDRAULIC SYSTEM SERVICING PANEL

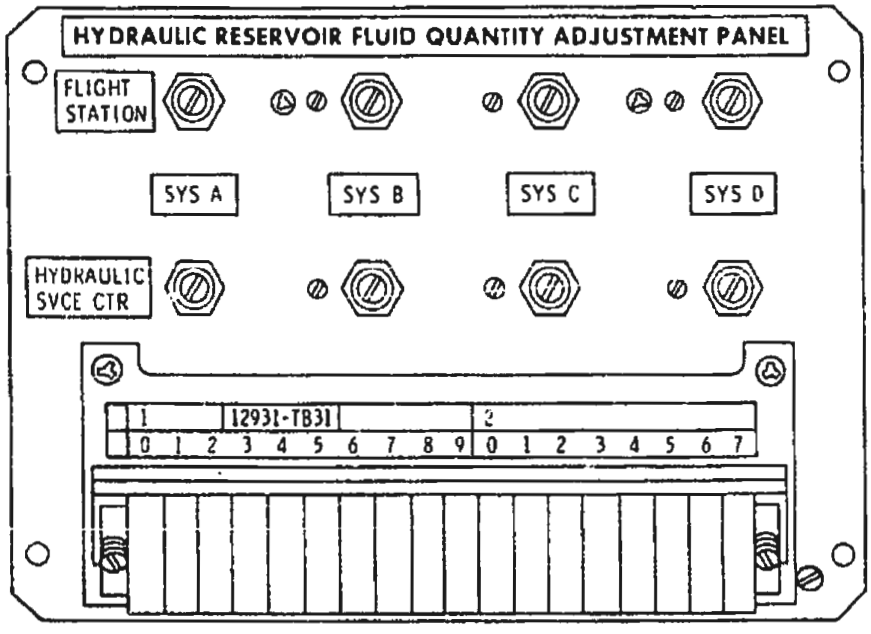
HH 6311
M1-0401-29-095

Hydraulic Fluid Quantity and Temperature Indicating System
Component Locator
Figure 6 (Sheet 2)

R



MID ELECTRICAL SERVICE CENTER



K

HH 6229
M1-0101-29-096

Hydraulic Fluid Quantity and Temperature Indicating System
Component Locator
Figure 6 (Sheet 3)

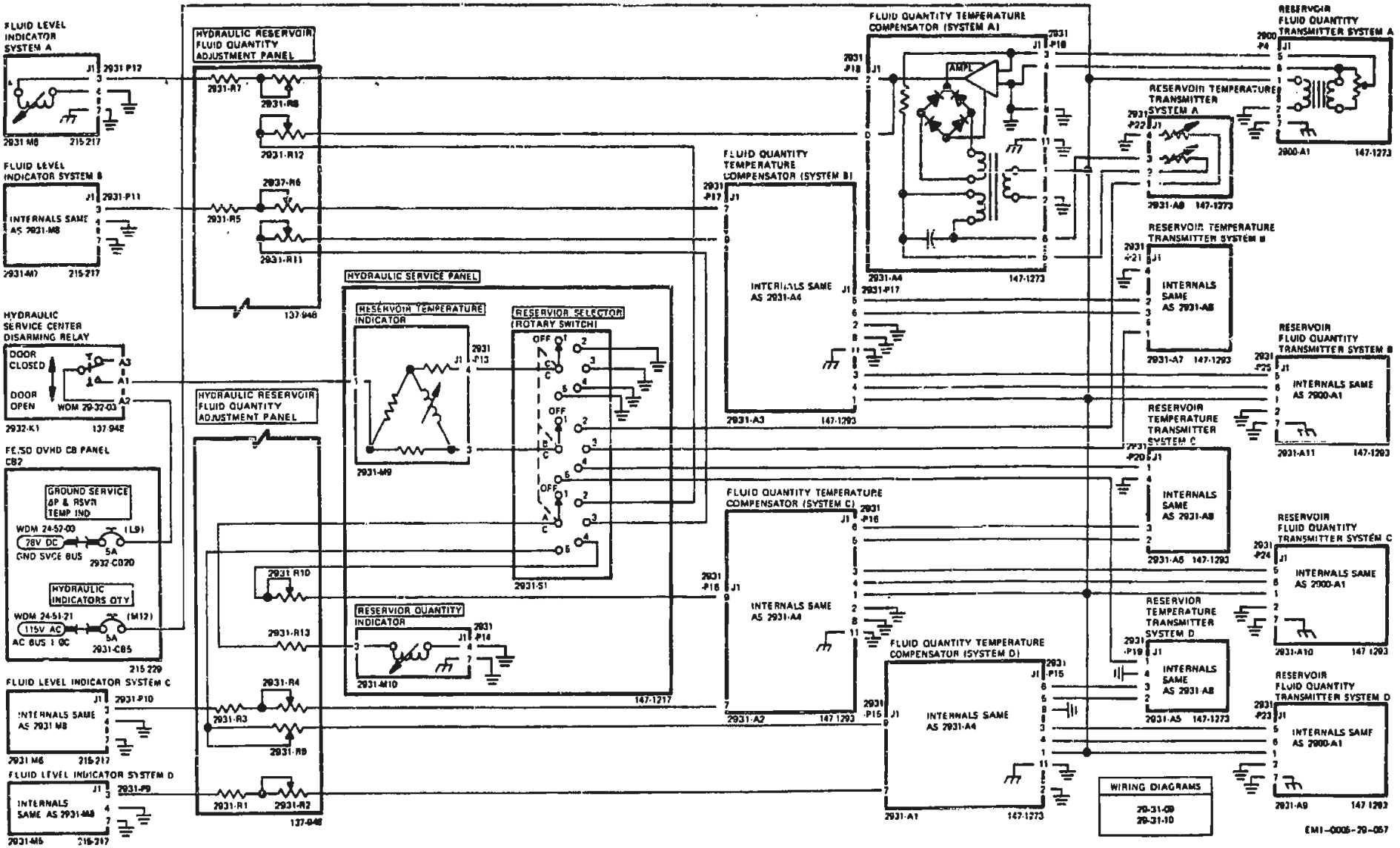
compensator adjusts for the fluid expansion and contraction as sensed by the temperature transmitter. The compensator transmits the 0 to 5.0V dc output through a line-adjusting resistor combination to each fluid quantity indicator on the HYDRAULIC SYSTEM panel or on the HYDRAULIC SERVICE PANEL, as selected by the RESERVOIR SELECTOR rotary switch.

The fluid temperature indicating system uses 28V dc power to energize a balanced bridge circuit formed by three fixed resistors, a temperature-controlled variable resistor, and a pointer-actuating coil across the bridge. A temperature variation sensed by the transmitter changes the coil current in the indicator to move the pointer across the scale. The RESERVOIR SELECTOR rotary switch is used to select any of the four temperature transmitters to be read on the RESERVOIR TEMPERATURE indicator (degrees F) on the HYDRAULIC SERVICE PANEL.

7. Firewall Shutoff Valve Switch Indicating System

A. Description and Operation

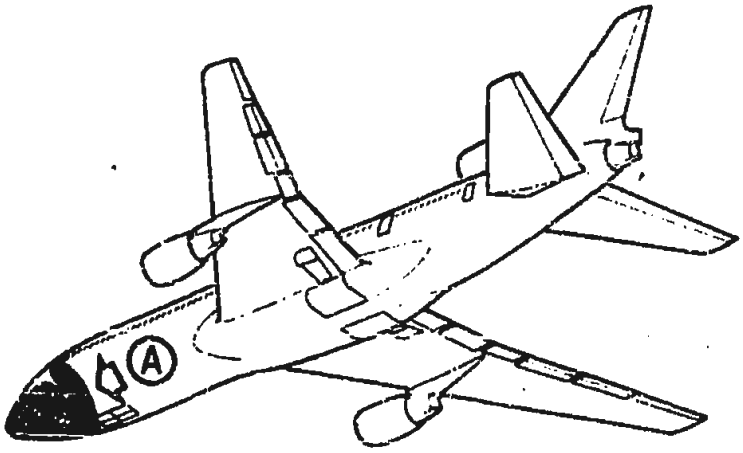
The firewall shutoff valve SUCTION S/O switchlights (Ref. Fig. 8 and 29-11-00) OFF legends come on whenever the related system switchlight is depressed to close the valve. The switchlight flowbar comes on in the open (released) position. The 28V dc powers the switchlights through dc bus No. 1, the indicator lights control box, and the dimming bus No. 3 and test bus No. 3 (Ref. 33-17-00).

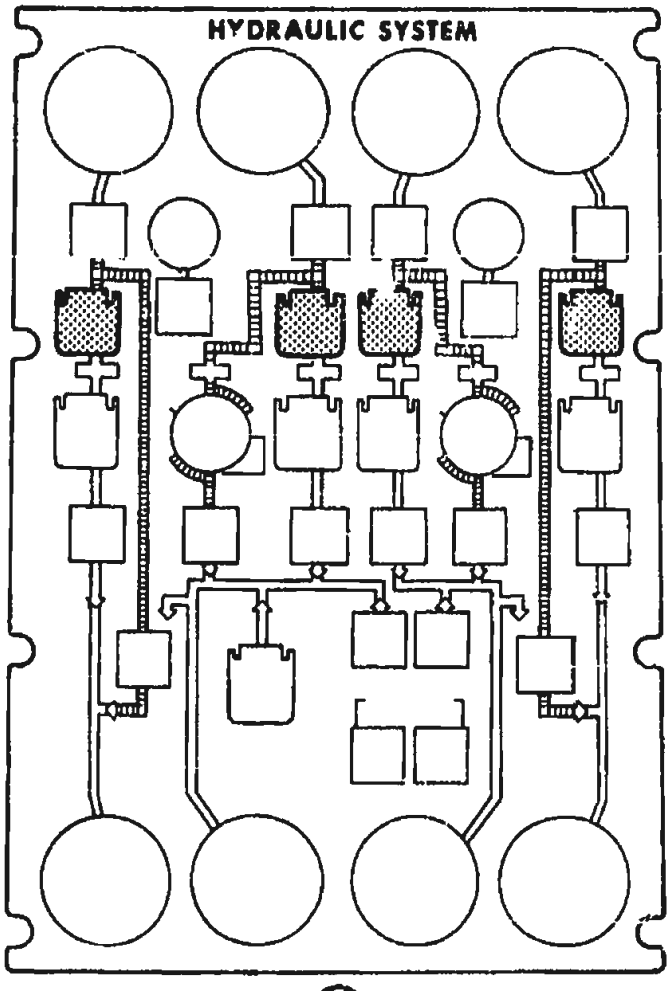


R Hydraulic Fluid Quantity and Temperature Indicating
R System Schematic
R Figure 7

EFFECTIVITY: ALL

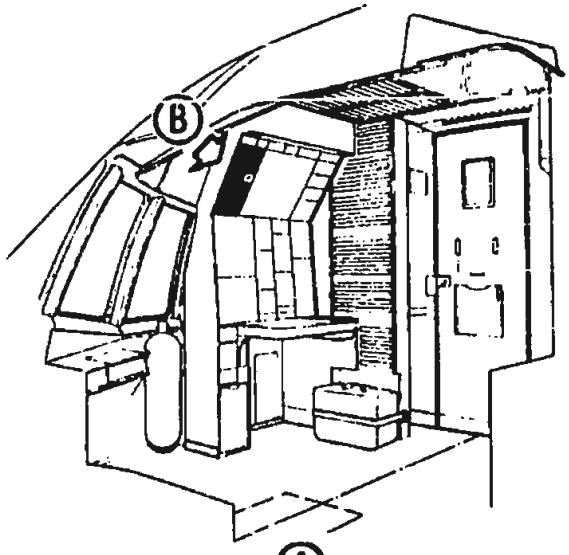
001B





B

HYDRAULIC SYSTEMS CONTROL PANEL



FLIGHT ENGINEER/SECOND OFFICERS STATION

HH 6358
M1-5101-29-113

Firewall Shutoff Valve Switch Indicating System
Component Locator
Figure 8

R

HYDRAULIC INDICATING SYSTEM - ADJUSTMENT AND TEST

1. General

The HYDRAULIC RESERVOIR FLUID QUANTITY ADJUSTMENT PANEL is located in the mid electrical service center. It is preset upon initial aircraft installation at the factory. No further adjustment should be necessary unless unauthorized tampering has taken place. However, if the following calibration test reveals that the indicators are in error, adjust the calibration resistors as outlined in the procedure.

CAUTION: DO NOT ATTEMPT TO READJUST THE "ZERO ADJUST" OR "RANGE ADJUST" SETTINGS ON THE TEMPERATURE COMPENSATORS. THESE ARE PRESET IN THE LABORATORY AND RESETTING IN THE AIRCRAFT WILL RESULT IN INCORRECT FLUID LEVEL INDICATIONS.

2. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Fluid Container, 5-gallon

Decade Resistance Box Tester (90 to 110 ohms required)

3. Referenced Procedures

12-13-01 Hydraulic Fluid Replenishing

24-41-00 External Power/Ground Service System - Maintenance Practices

4. Adjustment/Test

A. Calibration Test - Fluid Quantity Indication

(1) On Flight Engineer/Second officers overhead circuit breaker panel CB2, verify that circuit breakers GROUND SERVICE DP & RSVR TEMP IND (L9) and HYDRAULIC INDICATORS QTY (M12) are closed.

(2) Turn on electrical power (Ref. 24-41-00).

(3) Open hydraulic service center access doors 147AB and 147BB, zone 147.

R (4) On top of the applicable reservoir, set the reservoir
R thermal scale to 80°F (Ref. Fig. 501).

R (5) Disconnect the electrical connector from the
R temperature sensor located at the bottom of the
R applicable reservoir.

R (6) Connect test leads from decade resistance box to pins 2
R and 3 at aircraft harness connector.

R (7) Set the decade resistance to 99.69 ohms (80 degrees F).

R (8) Fill or drain hydraulic fluid in the reservoir, as
R required, (Ref. 12-13-01) until the direct reading
R quantity indicator/transmitter (on top of reservoir)
R indicates at the interface between red and green bands
R (LOW indication mark).

R (9) On the Flight Engineer/Second Officers HYDRAULIC SYSTEM
R panel, zone 215, verify that the applicable system
R FLUID LEVEL indicator needle points to the interface of
R the yellow and green bands.

R (10) On the HYDRAULIC SERVICE PANEL, zone 147, rotate the
R RESERVOIR SELECTOR switch to the applicable system and
R verify that the RESERVOIR QUANTITY indicator needle
R points to the calibration mark in the red zone
R (approximately 7.0 degrees of arc lower than the
R interface between the red and green bands).

R NOTE: The HYDRAULIC SERVICE PANEL RESERVOIR QUANTITY
R indicator is set 7.0 degrees lower to provide an
R added safety margin by requiring that the
R maintenance crew check the direct reading fluid
R level indicator on top of the reservoir.

R (11) If either the flight station or hydraulic service
R center hydraulic quantity indicators require
R calibration proceed as follows:

R (a) Gain access to the mid electrical service center,
R zone 137.

R (b) Locate the HYDRAULIC RESERVOIR FLUID QUANTITY
R ADJUSTMENT PANEL on the aft bulkhead, right side.

R (c) Adjust the applicable SYS A, B, C, or D, FLIGHT
R STATION or HYDRAULIC SVCE CTR calibration resistor
R screws until the fluid quantity indicator pointers
R are at the calibration positions as noted in Steps
R (9) and (10).

R (12) Verify that directional movement of compensation is as
R follows:

R (a) Increasing decade box resistance setting to 110.0
R ohms must result in decreasing quantity indication
R on the HYDRAULIC SYSTEM panel, zone 215, and on
R the HYDRAULIC SERVICE PANEL, zone 147.

R (b) Decreasing decade box resistance setting to 90.0
R ohms must result in increasing fluid quantity
R indication on HYDRAULIC SYSTEM panel and on
R HYDRAULIC SERVICE PANEL.

R (c) Reset the decade box resistance to 99.69 ohms (80
R degrees F).

R (13) Fill reservoir to FULL mark (Ref. 12-13-01) and verify
R that indicators on the HYDRAULIC SYSTEM panel and
R HYDRAULIC SERVICE PANEL also indicate an increase in
R quantity fluid level.

R (14) Disconnect decade box test leads from pins 2 and 3 at
R reservoir temperature transmitter aircraft harness
R connector.

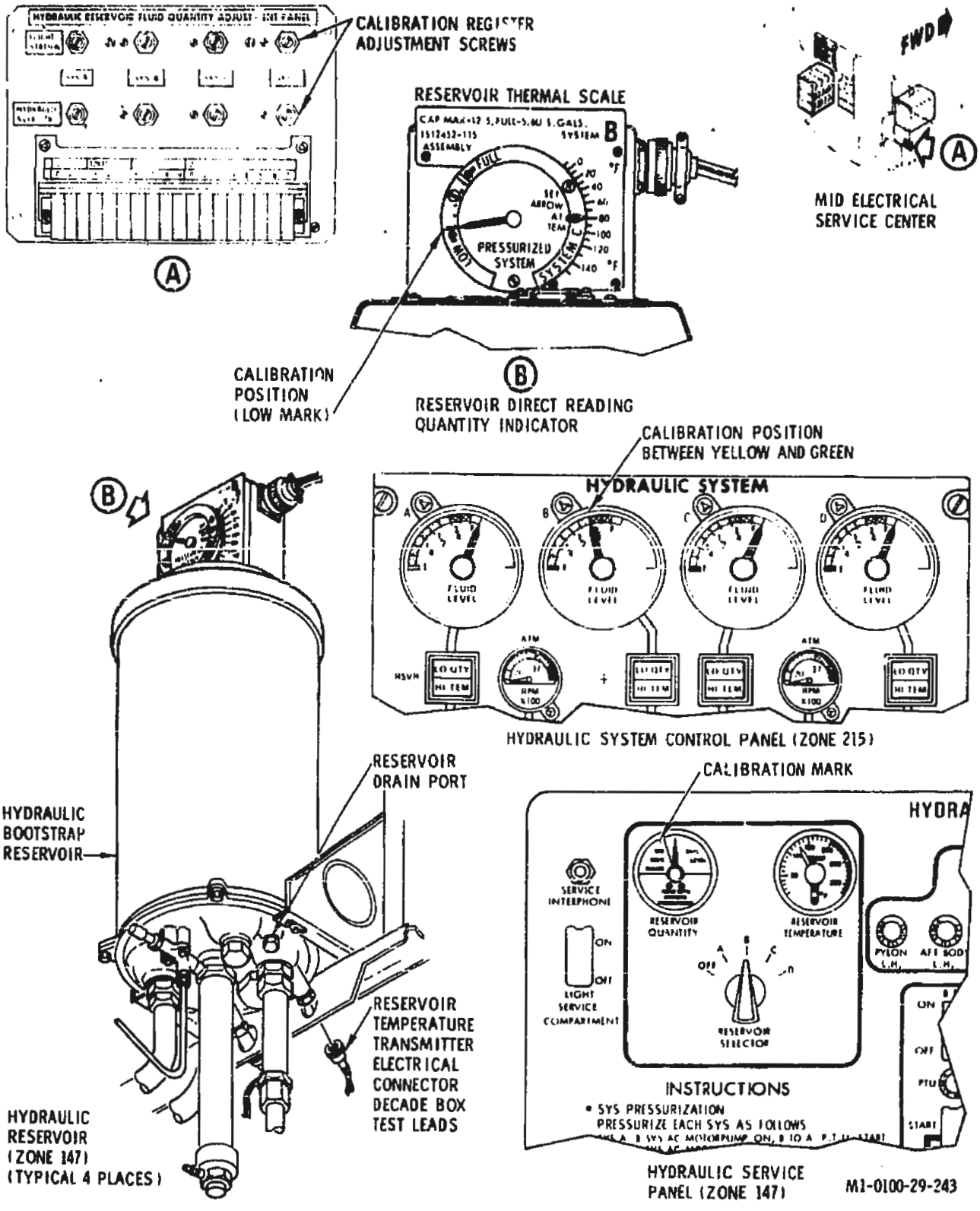
R (15) Reconnect electrical connector to reservoir temperature
R transmitter and lock-wire.

R (16) Rotate RESERVOIR SELECTOR switch to OFF.

R (17) Service the applicable hydraulic reservoir in
R accordance with RESERVOIR SERVICE INSTRUCTIONS placard
R (Ref. 12-13-01).

R (18) Turn off electrical power (Ref. 24-41-00).

R (19) Close and lock the hydraulic service center and mid
R electrical service center access doors.



R Calibration Test - Hydraulic Reservoir Fluid Quantity Indication
R Figure 501

HYDRAULIC FLUID QUANTITY INDICATOR (UNLIGHTED) REMOVAL AND INSTALLATION

1. Referenced Procedure

24-41-00 External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers HYDRAULIC INDICATORS QTY and RSVR for applicable system.

(2) Open hydraulic service center doors 147AB and 147BB.

(3) On HYDRAULIC SERVICE PANEL, zone 147, loosen instrument clamping screw at lower left side of RESERVOIR QUANTITY indicator.

(4) Remove indicator from front of panel and disconnect electrical connector.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Connect electrical connector to quantity indicator.

R R R (3) Insert indication into panel, rotate to proper position, and tighten instrument clamping screw to a torque of 5 to 8 lb in.

(4) Remove tags and close circuit breakers opened in Step 2A(1).

(5) Turn on electrical power (Ref. 24-41-00).

(6) Verify indicator operation by selecting each system using the RESERVOIR SELECTOR rotary switch and checking each system with reservoir direct-reading quantity indicator.

(7) Turn off electrical power (Ref. 24-41-00).

R R (8) Close and lock hydraulic service center access doors 147AB and 147BB.

HYDRAULIC PRESSURE TRANSMITTER - REMOVAL AND INSTALLATION

1. General

The pressure transmitters are located on the high-pressure filter modules (systems A and B on left sidewall, and systems C and D on right sidewall). Removal and installation procedures are identical for all four systems.

2. Equipment and Materials

Fluid Container (3 gallons)

Packing, NAS 1612-10, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Protective plug, LS 12995-10, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

3. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker HYDRAULIC INDICATORS PRESS (M13). R

(2) Open hydraulic service access doors 147AB and 147BB.

(3) On Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 147, tag the applicable controls to prevent pressurization of the system during the pressure transmitter removal and installation.

(4) Disconnect electrical connector from transmitter.

(5) Position fluid container to catch fluid drainage, remove pressure transmitter, and install protective plug.

B. Installation

(1) Verify that circuit breaker opened in Step 4A(1) is open and tagged, and that controls tagged in Step 4A(3) are as required.

(2) Place new packing on replacement transmitter. Lubricate packing with hydraulic fluid.

CR CR CR CR CR CR CAUTION: PART NBR VT-0107K HAS A VENT PORT ADJACENT TO THE ELECTRICAL RECEPTACLE. IF THE VENT PORT HAS A DUST CAP INSTALLED, THE CAP (OR PLUG) MUST HAVE A 0.045 RELIEF HOLE. THE LATEST UNITS PROVIDED BY THE MANUFACTURER HAVE A SCREENED RESTRICTOR FITTING IN THE VENT PORT.

(3) Remove protective plug and install transmitter into filter module manifold. Torque transmitter to 300 lb in. and lock-wire.

(4) Connect electrical harness plug to transmitter receptacle.

(5) Remove tag and close circuit breaker opened in Step 4A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Remove tags installed in Step 4A(3), and pressurize applicable system in accordance with instructions on HYDRAULIC SERVICE PANEL.

(7) Check pressure transmitter for leakage and operation by observing pressure on HYDRAULIC SERVICE PANEL and pressure indication on HYDRAULIC SYSTEM panel.

(8) Turn off hydraulic power (Ref. 29-11-00).

(9) Turn off electrical power (Ref. 24-41-00).

(10) Close and lock hydraulic service center doors 147AB and 147BB.

FLUID QUANTITY TRANSMITTER - MAINTENANCE PRACTICES

1. General

The following procedure is applicable to an inoperative fluid quantity indicating system. Reservoir fluid quantity must be adequate for flight and low quantity caution lights must be operative.

R R NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MEL.

2. Deactivation

A. Fluid Quantity Indicating System

(1) Gain access to hydraulic service center, zone 147.

(2) Verify that the applicable reservoir fluid level is adequate for flight by performing the RESERVOIR FLUID QUANTITY CHECK in accordance with instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICE INSTRUCTIONS placard (on sidewall between reservoirs).

(3) On Flight Engineer/Second Officers LIGHTS test panel, zone 215, perform caution and warning lights test to verify that the applicable reservoir LO QTY caution light on HYDRAULIC SYSTEM panel is operative.

(4) Tag Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215. Tag must specify which of the four FLUID LEVEL indicating systems is inoperative.

(5) Make appropriate entry in aircraft log book.

HYDRAULIC FLUID QUANTITY TRANSMITTER - REMOVAL AND INSTALLATION

1. Referenced Procedure

24-41-00 External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers GROUND SERVICE, (delta) P & RSVR TEMP IND (L9), and HYDRAULIC - INDICATORS - QTY (M12).

(2) Open service center access doors 147AB and 147BB. The hydraulic fluid quantity transmitters (Ref. Fig. 401) are mounted on the top cover of each reservoir. Removal and installation procedures are identical for each. Verify that applicable reservoir is depressurized before continuing.

(3) Remove and retain for the replacement transmitter the fluid volume scale and the thermal scale as follows:

(a) Remove the three mounting screws from the quantity transmitter fluid volume scale window. Remove the window and the fluid volume scale. Retain the scale for installation on the new transmitter and reinstall the window on the transmitter.

(b) Remove the three mounting screws from the quantity transmitter thermal scale. Retain the thermal scale for installation on the new transmitter.

(4) Disconnect seal leak overboard drain line and quantity transmitter electrical connector.

(5) Remove upper support bracket and cover screws.

R (6) Replace screw on left side of reservoir with long screw
R or threaded stock to prevent clip from dropping into
R reservoir (Ref. Fig. 401).

R (7) Tilt or slide cover aside from top of reservoir to gain access into reservoir.

CAUTION: TRANSMITTER CABLE IS SPRING-LOADED WITH A 3 to 6-POUND PULL. RESTRAIN CABLE WHEN REMOVING CABLE ADAPTER NUT FROM PISTON HEAD.

R R (8) Remove cable adapter nut from piston using a crowfoot or short wrench.

R (9) Remove transmitter mounting screws and transmitter from cover.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Verify the operation of the low level switch by checking continuity across pins 3 and 4 of the transmitter while extending the transmitter cable until the switch closes.

(3) Mount transmitter on cover and install mounting screws.

(4) Hand-thread cable adapter nut into piston head.

(5) Tighten cable adapter nut.

R R CAUTION: VERIFY THAT CLIP IS PROPERLY LOCATED BETWEEN COVER AND UPPER RING WHEN INSTALLING COVER.

(6) Position cover and secure with cover screws.

(7) Connect seal leak overboard drain line connector to fitting.

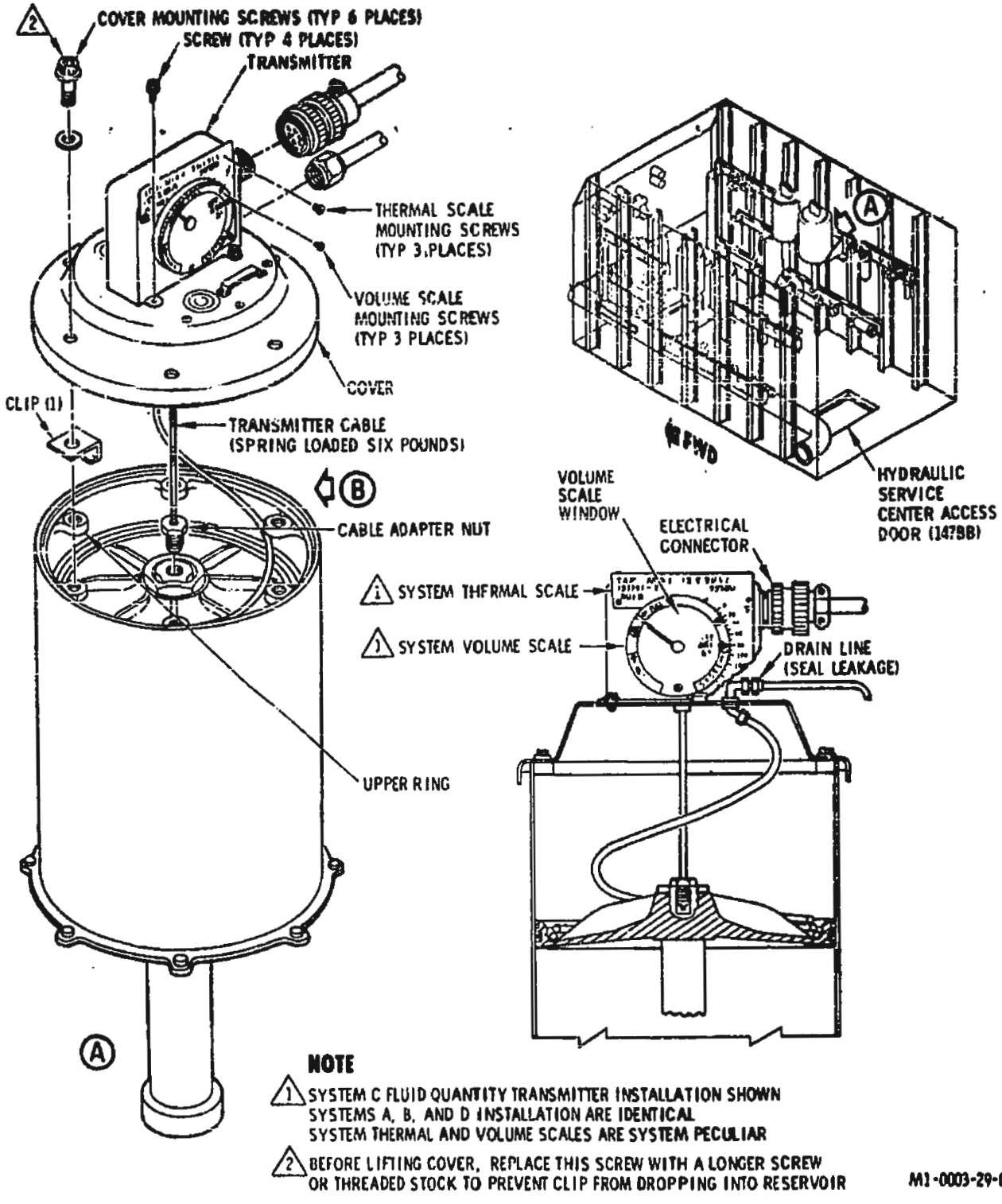
(8) Connect electrical connector to quantity transmitter.

(9) Install the applicable system fluid volume scale and thermal scale as follows:

(a) Remove the three mounting screws from the fluid volume scale window. Remove the window and install the applicable hydraulic system fluid volume scale. Install the window and secure with mounting screws.

(b) Install the applicable hydraulic system thermal scale and secure with mounting screws.

(10) Remove tags and close circuit breakers opened in Step 2A(1).



NOTE

1. SYSTEM C FLUID QUANTITY TRANSMITTER INSTALLATION SHOWN
   SYSTEMS A, B, AND D INSTALLATION ARE IDENTICAL
   SYSTEM THERMAL AND VOLUME SCALES ARE SYSTEM PECULIAR
2. BEFORE LIFTING COVER, REPLACE THIS SCREW WITH A LONGER SCREW OR THREADED STOCK TO PREVENT CLIP FROM DROPPING INTO RESERVOIR

M1-0003-29-087

R R R Hydraulic Reservoir Quantity Transmitter
Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND MAIN
R LANDING GEAR DOOR SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND MAIN LANDING GEAR DOOR
R TRAVEL AREAS.

R THE AFFECTED HYDRAULIC SYSTEM(S) CAN ACCEPT
R HYDRAULIC PRESSURE.

(11) Turn on electrical power (Ref. 24-41-00) and check fluid quantity transmitter operation by comparing quantity indications on the reservoir direct-reading gage with the HYDRAULIC SERVICE PANEL RESERVOIR QUANTITY indicator, zone 147, and the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel FLUID QUANTITY indicator, zone 215, for the applicable system.

(12) Turn off electrical power (Ref. 24-41-00).

(13) Close and lock service center access doors.

FLUID QUANTITY INDICATOR (LIGHTED) - REMOVAL AND INSTALLATION

1. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker HYDRAULIC INDICATORS QTY (M12). R

(2) On front of HYDRAULIC SYSTEM panel, zone 215, loosen instrument clamping screw at upper edge of applicable quantity indicator (Ref. Fig. 401).

(3) Pull instrument forward and disconnect electrical connector at rear of instrument.

NOTE: The instrument can be removed from panel clamp using tape on glass face or small suction cup. Should the instrument not come out by these methods, loosen the panel attaching screws and pull panel forward on slides and push instrument out from rear of panel.

B. Installation

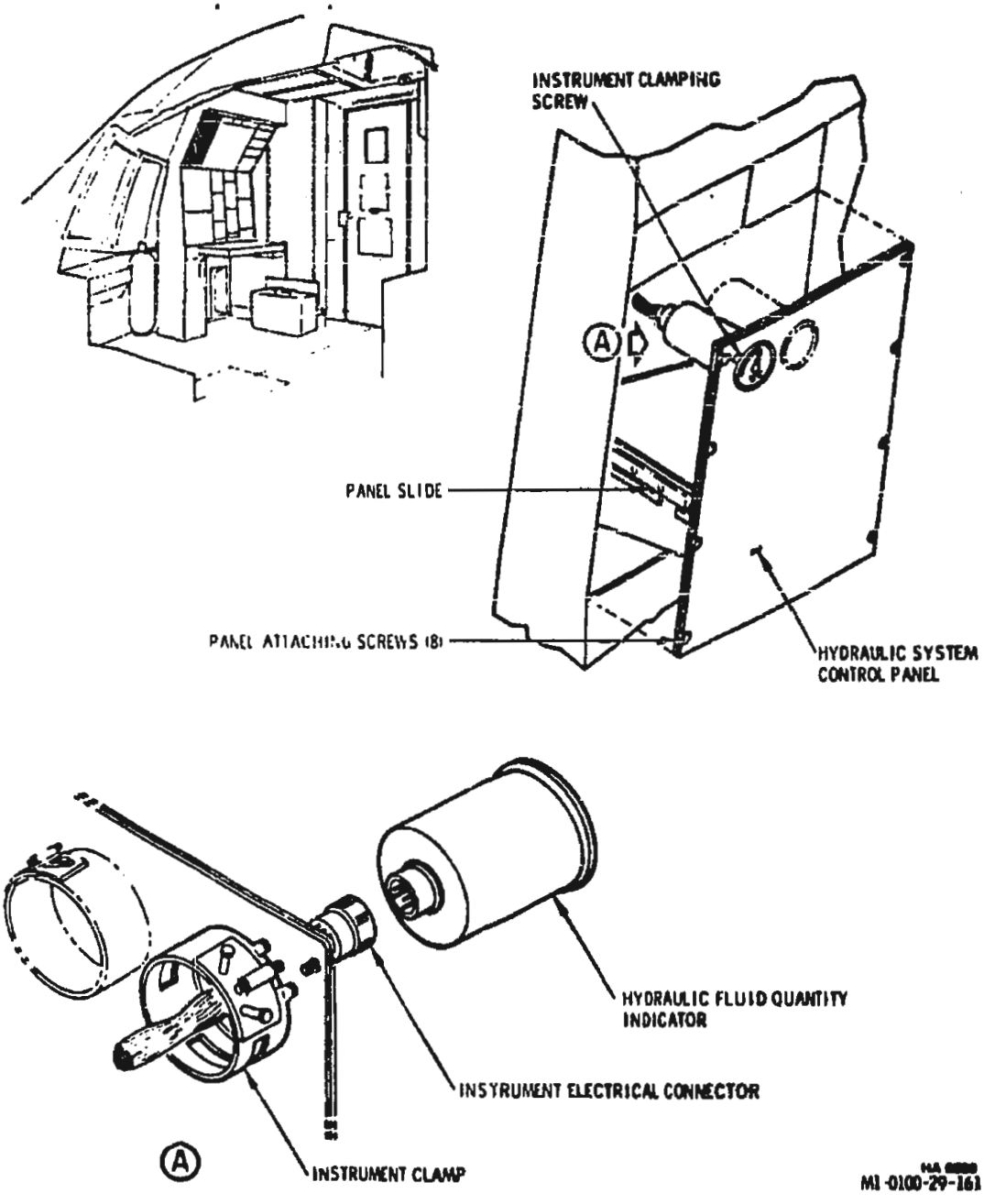
(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

(2) Connect electrical harness plug to instrument receptacle.

(3) Insert instrument into panel opening, position instrument for proper orientation, and tighten clamping screw to a torque of 5 to 8 lb in.

(4) Slide panel into installed position and secure mounting screws (if panel was extended for instrument removal).

(5) Remove tag and close circuit breaker opened in Step 2A(1).



R Fluid Quantity Indicator (Lighted) - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
R
050B

(6) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Open hydraulic service center access door 147AB.

(8) Pressurize applicable hydraulic system and check reservoir level in accordance with instructions on HYDRAULIC SERVICE PANEL and RESERVOIR SERVICING INSTRUCTIONS placards, zone 147.

R R R (9) Fluid quantity indication on Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and on reservoir fluid level indicator must be the same.

(10) Check instrument lighting by operating the TEST button and DIM/BRT control on Flight Engineer/Second Officers LIGHTS panel, zone 215.

(11) Turn off hydraulic system pressure (Ref. 29-11-00).

(12) Turn off electrical power (Ref. 24-41-00).

(13) Close and lock hydraulic service center door 147AB.

RESERVOIR TEMPERATURE TRANSMITTER - REMOVAL AND INSTALLATION

1. Equipment and Materials

O-ring, LS10116-10, or equivalent

Fluid container (6 gallons minimum for systems A, B, and D, and 10 gallons for system C)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Protective caps and plugs

2. Referenced Procedures

12-13-00	Hydraulic Fluid Replenishing - Servicing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit
R breaker GROUND SERVICE (DELTA) P & RSVR TEMP IND (L9).

(2) Open hydraulic service center access doors 147AB and 147BB.

(3) Ensure that applicable hydraulic system is shut off
R (Ref. 29-11-00) and verify that the reservoir is
R depressurized. Tag Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and HYDRAULIC SERVICE PANEL, zone 147.

(4) Position fluid container under applicable reservoir drain port and remove drain plug. Open air bleed valve at bottom of reservoir pressurization cylinder and drain reservoir (Ref. Fig. 401).

(5) Disconnect electrical connector from reservoir temperature transmitter located on bottom of reservoir.

(6) Remove transmitter from reservoir.

R (7) Place protective caps and plugs on electrical plugs and
R reservoir temperature transmitter opening.

R B. Installation

R (1) Verify that circuit breaker opened in Step 3A(1) is
R open and tagged.

R (2) Ensure that hydraulic system pressure is off and that
R controls are tagged.

R (3) Remove protective caps and plugs.

R (4) Lubricate O-ring and transmitter threads with hydraulic
R fluid, and install transmitter in reservoir and
R lock-wire.

R (5) Connect electrical connector and lock-wire.

R (6) Remove tag and close circuit breaker opened in Step
R 3A(1).

R (7) Turn on electrical power (Ref. 24-41-00).

R (8) Fill and bleed reservoir (Ref. 12-13-00).

R (9) Remove tags from controls and turn on applicable system
R hydraulic power (Ref. 29-11-00).

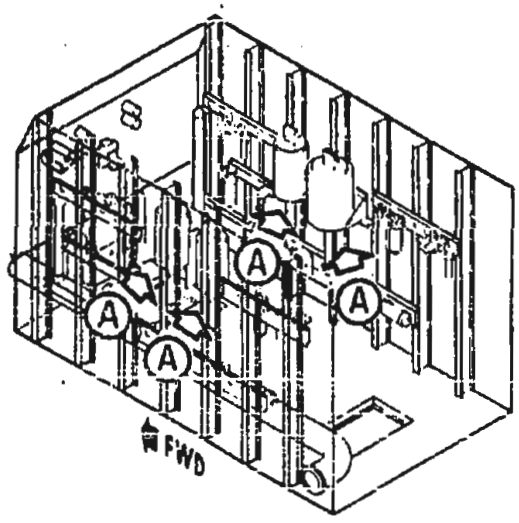
R (10) Check reservoir temperature transmitter installation
R for leakage.

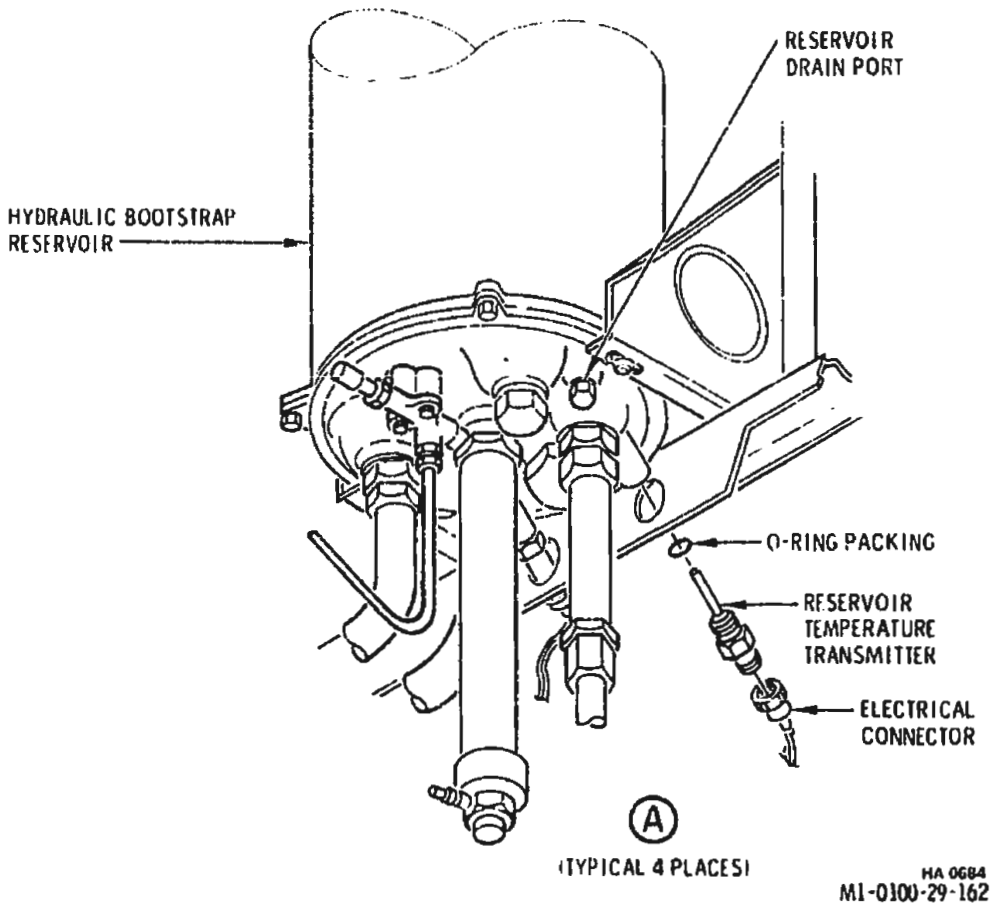
R (11) Check temperature indication on HYDRAULIC SERVICE PANEL
R for proper operation.

R (12) Turn off hydraulic power (Ref. 29-11-00).

R (13) Turn off electrical power (Ref. 24-41-00).

R (14) Close hydraulic service center access doors 147AB and
R 147BB.





Reservoir Temperature Transmitter - Removal and Installation
Figure 401

TEMPERATURE COMPENSATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, 0.020-inch diameter, or equivalent

2. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers HYDRAULIC INDICATOR QTY and QTY TEMP PRESS IND LT SYS (as applicable) RSVR.

(2) Open hydraulic service center access doors 147AB and 147BB.

(3) Gain access to the applicable compensator located above the applicable system reservoir on the service center sidewall structure.

(4) Disconnect electrical connector from compensator.

(5) Remove mounting nuts, washers, and bolts.

(6) Remove compensator.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Place temperature compensator in position and install mounting bolts, washers, and nuts.

(3) Connect electrical connector to temperature compensator and lock-wire.

R R CAUTION: DO NOT REMOVE CAPS OR CHANGE POTENTIOMETER TRIM SCREW SETTINGS.

(4) Remove tags and close circuit breakers opened in Step 3A(1).

(5) Turn on electrical power (Ref. 24-41-00).

R
R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Pressurize applicable hydraulic system (Ref. 29-11-00).

(7) Check applicable hydraulic fluid quantity indicator on Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215 and indicator on HYDRAULIC SERVICE PANEL, zone 147, for proper fluid quantity indication.

(8) Turn off hydraulic system pressure (Ref. 29-11-00).

(9) Turn off electrical power (Ref. 24-41-00).

(10) Close and lock hydraulic service center access doors.

RESERVOIR PRESSURE GAGE - MAINTENANCE PRACTICES

1. Deactivation

R R NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MEL.

When a reservoir pressure indicator is inoperative, verify reservoir pressurization by performing AIR CHECK in accordance with RESERVOIR SERVICE INSTRUCTIONS placard and HYDRAULIC SERVICE PANEL in the hydraulic service center. Make appropriate entry in aircraft log book.

NOTE: During AIR CHECK verify that the needle on the fluid quantity indicator dial on top of the reservoir moves when the depressurization valve button is depressed. This verifies that the reservoir is being pressurized.

HYDRAULIC CAUTION INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

The hydraulic caution indicating system alerts the flight crew and ground crew of an operational malfunction in any of the four hydraulic systems. A HYDRAULIC SYSTEM caution annunciator light on the pilots center instrument panel, zone 210, alerts either the Captain or First Officer of a hydraulic malfunction. This light is energized by a logic OR gate in the indicator lights control box (Ref. 33-17-00). The OR gate is actuated by the same power source that lights any of the LO QTY/HI TEM and HI TEM/LO PR caution indicator lights on the HYDRAULIC SYSTEM panel, zone 215. The specific functions of each system provide power or switch closures to light the other caution indicator lights on the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel. A filter differential pressure indicating system in the hydraulic service center, zone 147, alerts the ground crew to a clogged filter in the hydraulic fluid lines.

2. Reservoir Low-quantity and High-temperature Caution Indicating System

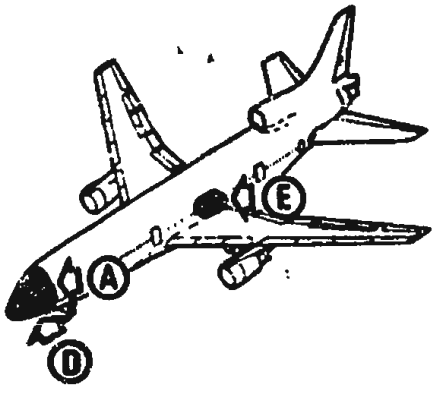
A. Description and Operation

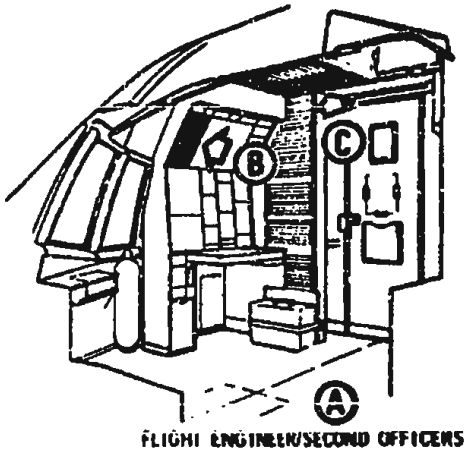
The hydraulic reservoir low-quantity and high-temperature caution indicating system consists of four LO QTY/HI TEM caution indicator lights on the HYDRAULIC SYSTEM control panel, zone 215, (Ref. Fig. 1). A fluid quantity transmitter and high-temperature switch are installed in each reservoir in the hydraulic service center, zone 147. The transmitter and switch provide the circuit closure to light the LO QTY/HI TEM caution indicator lights (Ref. Fig. 2). The high-temperature switch is set to close at 205 (±5) degrees F. The fluid quantity transmitter is mechanically operated to close when the reservoir fluid level drops to 1.3 quarts for hydraulic system A, B, or D. The transmitter for system C closes when the fluid level drops to 4.9 quarts.

3. Systems B and C, Air Turbine Motor and Electric Motor-driven Pump Low-pressure Caution Indicating System

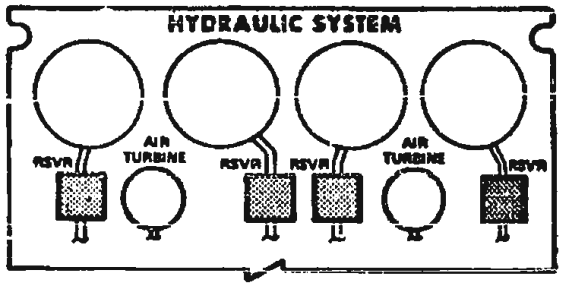
A. Description and Operation

The low-pressure caution indicating system alerts the Flight Engineer/Second Officer of a low-pressure condition in the hydraulic sytem. The system B and C pressure switches are

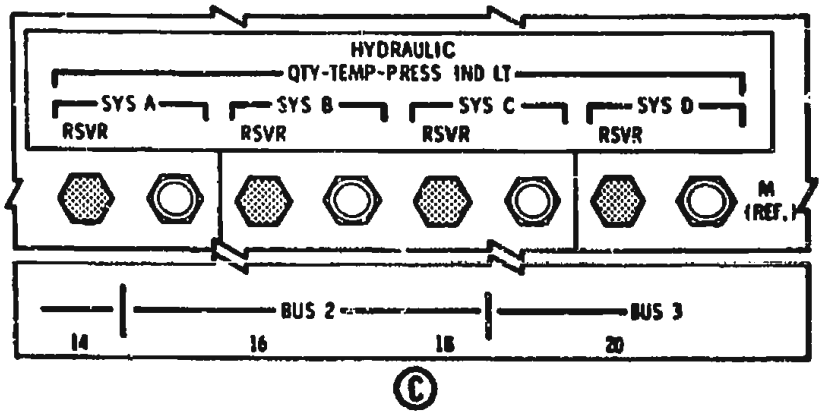




FLIGHT ENGINEER/SECOND OFFICERS STATION



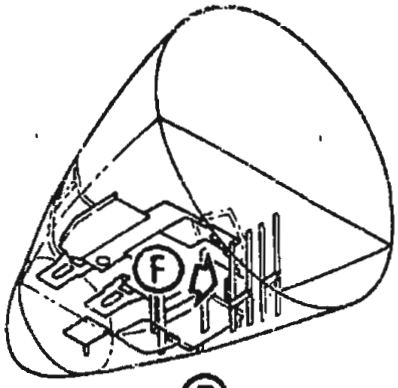
HYDRAULIC SYSTEM CONTROL PANEL



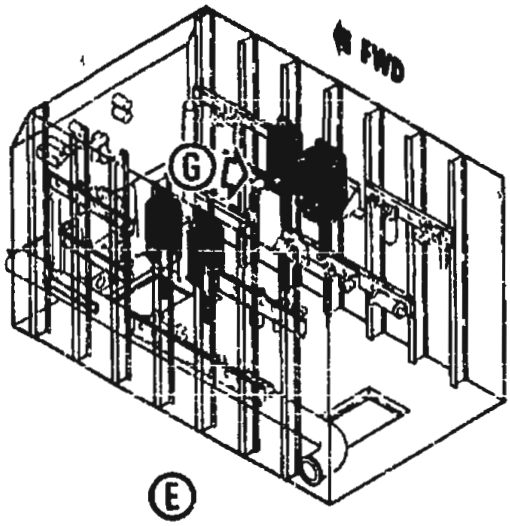
FLIGHT ENGINEER/SECOND OFFICER OVERHEAD CIRCUIT BREAKER PANEL
CB2

HSI 4230
M1-A00-29-099

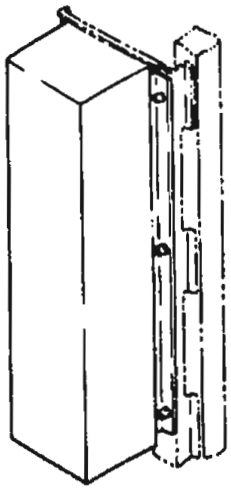
Reservoir Caution Indicating System Component Locator
Figure 1 (Sheet 1)



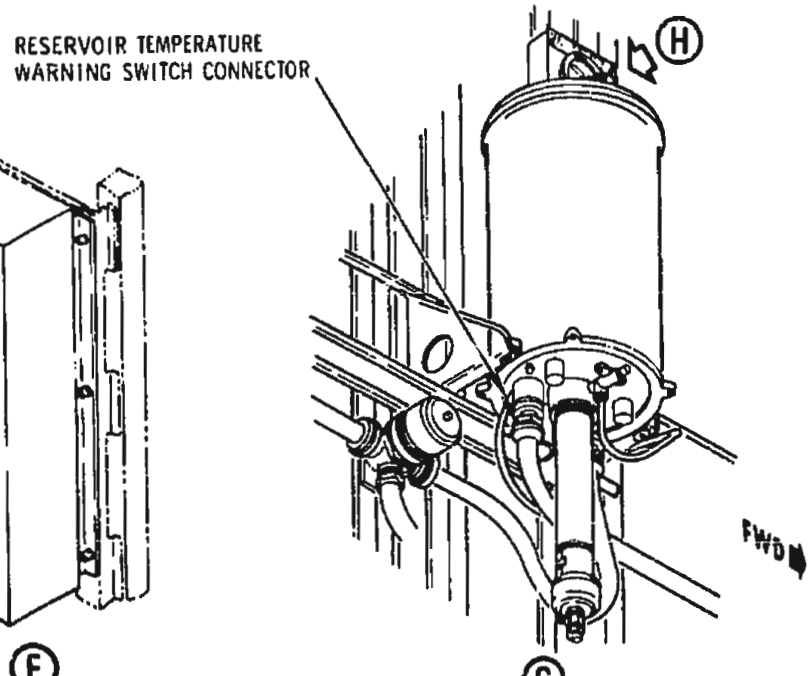
(D)
FORWARD ELECTRONIC SERVICE CENTER



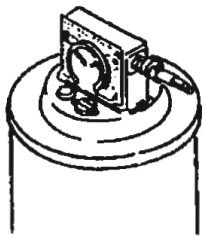
(E)
HYDRAULIC SERVICE CENTER



(F)
INDICATOR LIGHTS CONTROL BOX
(REF 33-17-00)



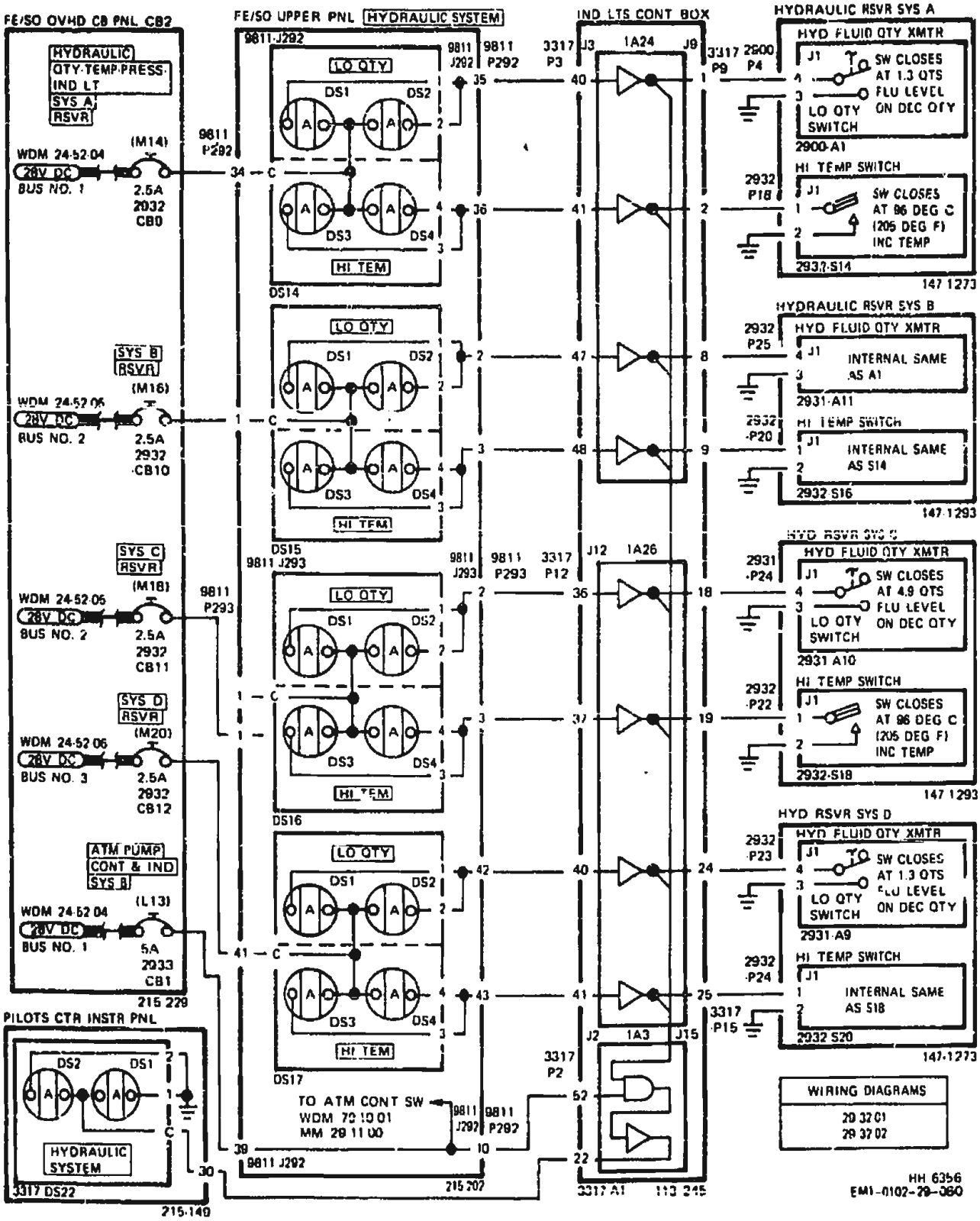
(G)
HYDRAULIC SYSTEM RESERVOIR



(H)
FLUID QUANTITY
TRANSMITTER

HH 6282
M1-0101-29-100

R Reservoir Caution Indicating System Component Locator
R Figure 1 (Sheet 2)



R R **Reservoir Caution Indicating System Schematic**
Figure 2

in the high-pressure filter module in the hydraulic service center, zone 147, (Ref. Fig. 3). The air turbine motor (ATM) rotary control switches and HI TEM/LO PR caution indicator lights are on the HYDRAULIC SYSTEM control panel, zone 215. The pressure switch is set to close whenever the system pressure falls below 700 psig. The ATM rotary switch, when turned to ON or OVSP TEST position, completes the power circuit through the pressure switches to the caution indicator lights.

4. Systems B and C, Air Turbine Motor-driven Pump High-temperature Caution Indicating System

A. Description and Operation

The high-temperature caution indicating system alerts the Flight Engineer/Second Officer to a high-temperature condition at the case drain outlet. Both switches are installed in the air turbine motor (ATM) pump case drain filter modules in the hydraulic service center, zone 147, (Ref. Fig. 3 and 29-11-00). The ATM rotary control switches and HI TEM/LO PR caution indicator lights are on the HYDRAULIC SYSTEM control panel, zone 215. Each snap-action thermal switch is set to close when the fluid temperature rises above 250 (±5) degrees F. The ATM rotary control switch, when turned to the ON or OVSP TEST position, completes the power circuit through the thermal switch to the caution indicator light.

5. Systems A, B, C, and D Engine-driven Pump Low-pressure Caution Indicating System

A. Description

The low-pressure caution indicating system alerts the Flight Engineer/Second Officer to a low-pressure condition in the hydraulic power systems. The paired caution indicator lights and guarded PUMP S/O and SUCT S/O switchlights (OFF/light bar) are on the HYDRAULIC SYSTEM control panel, zone 215, (Ref. Fig. 4). Each pressure switch is installed in the high-pressure filter housing in the pressure line from each pump. System A housing is in the left wing pylon/rear fairing, zone 453. Systems B and C switches are in the afterbody mid/lower section, zone 317. System D switch is in the right wing pylon/rear fairing, zone 463. Each pressure switch is set to close whenever the system pressure falls below 700 psig. Depressing the PUMP S/O and SUCT S/O switchlight (OFF/light bar) causes the light bar to come on and completes the dc power circuit through the pressure switch to the caution indicator lights.

6. Systems A, B, C, and D Case Drain High Temperature Caution Indicating System

A. Description and Operation

The high-temperature caution indicating system alerts the Flight Engineer/Second Officer to a high-temperature condition over 250 (±5) degrees F at the case drain outlet. The four thermal switches are installed in the pump case drain hydraulic lines of the four hydraulic systems (Ref. Fig. 4). System A thermal switch is in the left wing pylon/rear fairing, zone 453. System B and C switches are in the afterbody mid-lower section, zone 317. System D switch is in the right wing pylon/rear fairing, zone 463. Depressing the PUMP S/O and SUCT S/O switchlight on the HYDRAULIC SYSTEM control panel, zone 215, completes the dc power circuit through the snap-action thermal switch to the applicable HI TEM/LO PR caution indicator light.

7. Filter Differential Pressure Caution Indicating System

A. Description

The 24 filter differential pressure switches and 5 (PRESS TO TEST) CLOGGED FILTER WARNING LIGHTS alert maintenance personnel to a clogged filter in any of the four hydraulic systems. The switches are installed in all filter modules and housings except the flight controls servo package filters (Ref. Fig. 5).

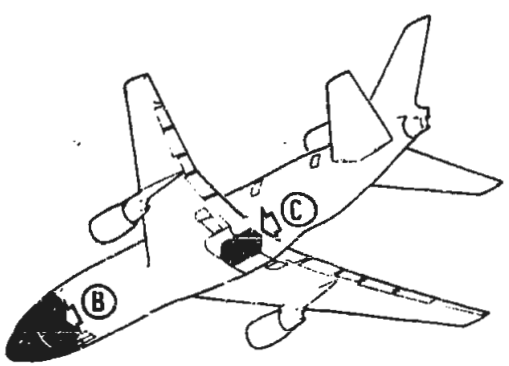
The CLOGGED FILTER WARNING LIGHTS are installed on the HYDRAULIC SERVICE PANEL, zone 147, and are placarded to indicate the general area location of the filter assembly. The area placards and the filters involved are as follows:

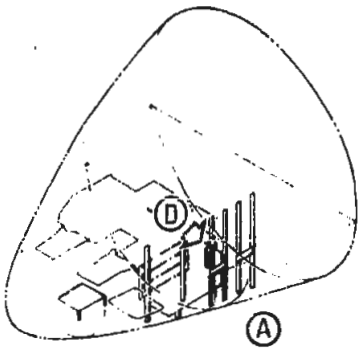
PYLON L. H., zone 453: one high-pressure filter and one single-bowl case drain filter for engine No. 1 hydraulic pump A1

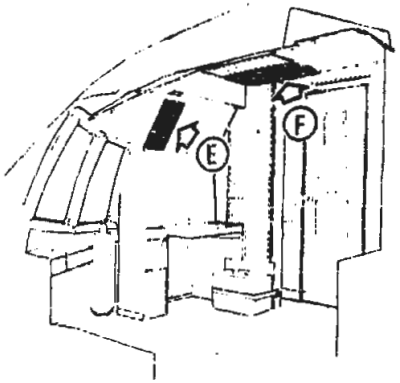
PYLON R.H., zone 463: one high-pressure filter and one single-bowl case drain filter for engine No. 3 hydraulic pump D1

R AFT BODY L.H., zone 439: one high-pressure filter and one single-bowl case drain filter for engine No. 2 hydraulic pump B1

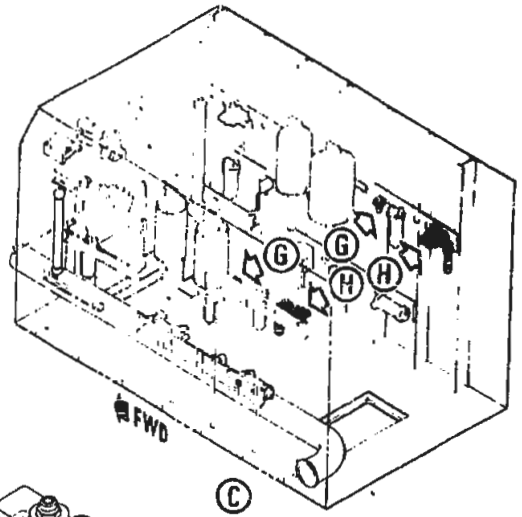
R AFT BODY R.H., zone 439: one high-pressure filter and one single-bowl case drain filter for engine NO. 2 hydraulic pump C1







B
FLIGHT ENGINEER SECOND OFFICERS STATION



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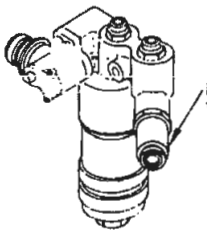
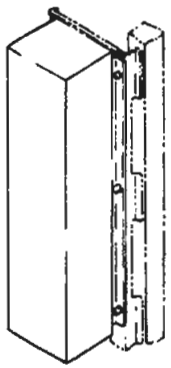
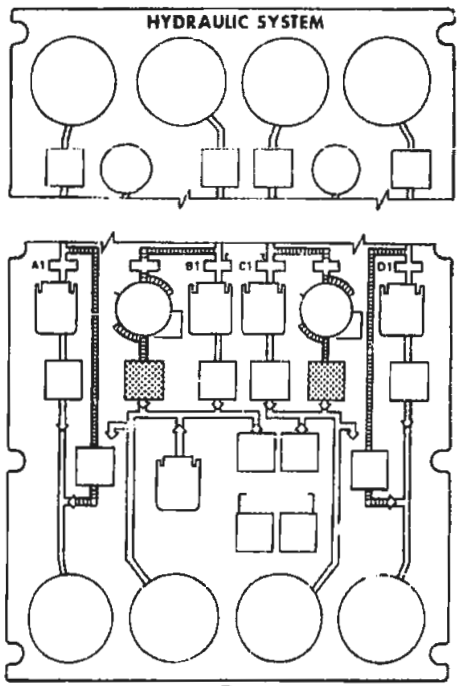


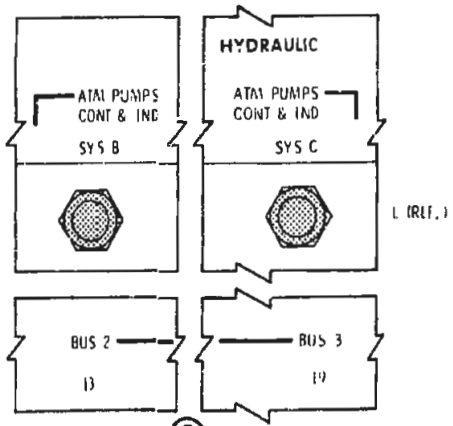
G
SINGLE BOWL CASE
DRAIN FILTER



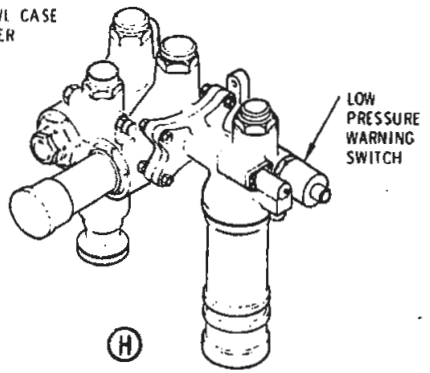
D
INDICATOR LIGHTS CONTROL BOX
(REF. 33-17-00)



E
HYDRAULIC SYSTEM CONTROL PANEL - CASE DRAIN
HIGH TEMPERATURE AND LOW PRESSURE CAUTION LIGHTS



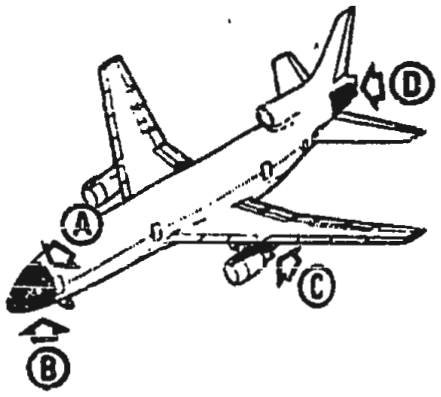
F
FLIGHT ENGINEER SECOND OFFICERS
OVERHEAD CIRCUIT BREAKER PANEL
CB2

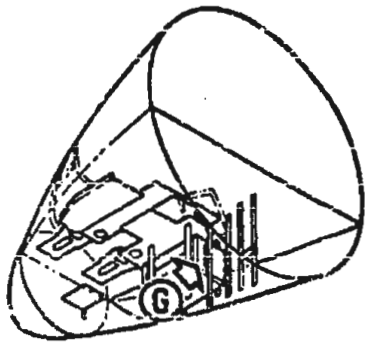


H
HIGH PRESSURE FILTER MODULE

G337
A11-0101-29-101

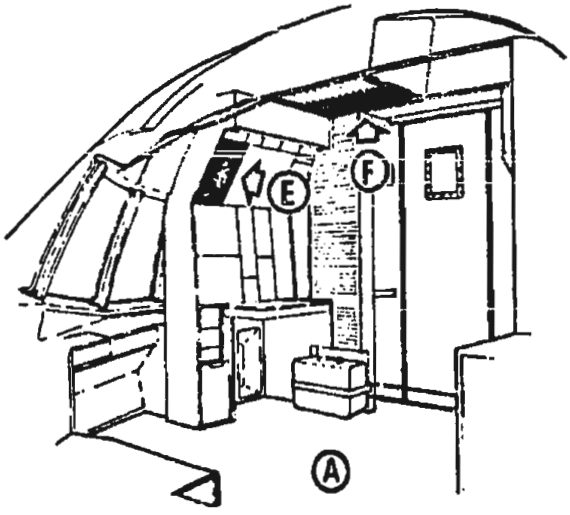
R Systems B and C (ATM Pumps) Caution Indicating System
R Component Locator
R Figure 3



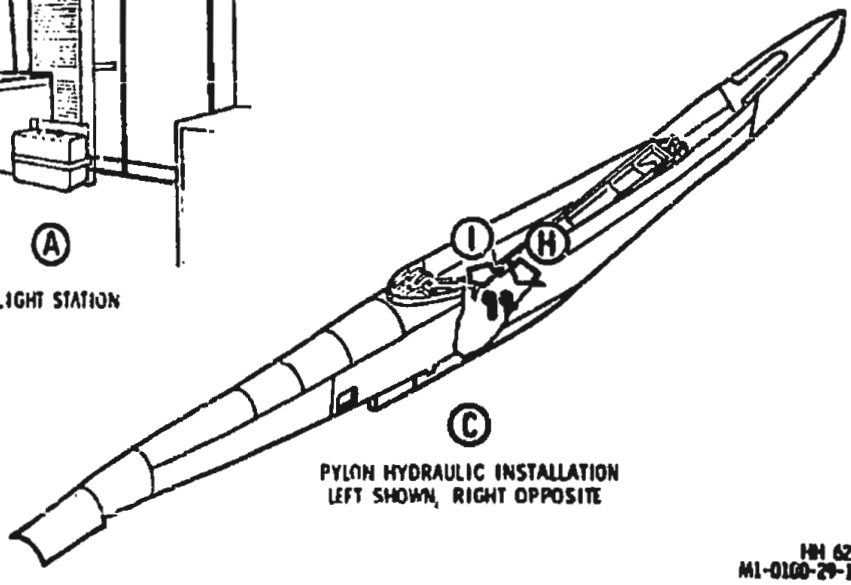


B

FORWARD ELECTRONIC SERVICE CENTER



FLIGHT STATION



PYLON HYDRAULIC INSTALLATION
LEFT SHOWN, RIGHT OPPOSITE

HH 6231
M1-0100-29-102

C Primary Systems (Engine-driven Pumps) Caution Indicating System
C Component Locator
CR Figure 4 (Sheet 1)

R EFFECTIVITY: ALL
R
051B

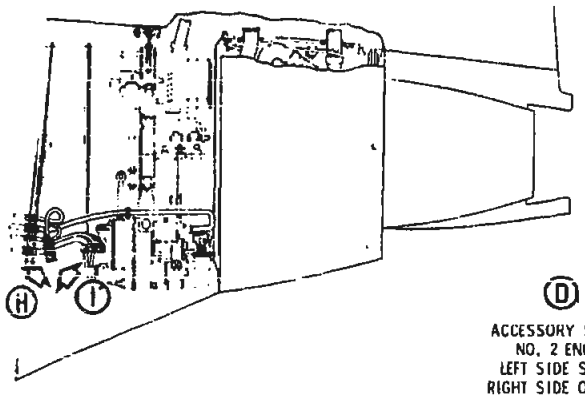
SERVICE CENTER, zone 147: four return filter modules for systems A, B, C, and D; four high-pressure filter modules and four single-bowl case drain filters for the air turbine motor (ATM) hydraulic pumps B2 and C2, and the pump sections of the power transfer units (PTU) B to A and C to D.; two dual-bowl case drain filters for the electric motor-driven pumps B3 and C3 and the motor sections of the B to A and C to D PTU.

B. Operation

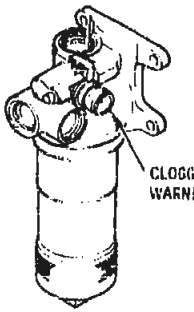
CAUTION: DO NOT MANUALLY ACTUATE RED INDICATOR BUTTON TO EXTENDED (TRIPPED) POSITION. MANUAL ACTUATION WILL PERMANENTLY DAMAGE UNIT.

Each switch is set to close when the hydraulic fluid differential pressure across the filter exceeds 115 (±15) psid. A red indicator pops out to provide visual warning at each filter housing. Manually depressing the red mechanical indicator resets the pressure switch.

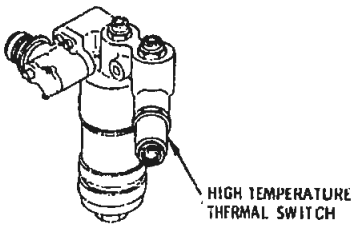
Each group of switches (Ref. Fig. 6) is connected to a CLOGGED FILTER WARNING LIGHT on the HYDRAULIC SERVICE PANEL to indicate the general location of the clogged filter that actuated the switch. All filters in the indicated area should be inspected because of the possibility of other filters also being clogged. The warning light circuit is completed only when the hydraulic service center access doors are opened. This operation will energize the disarming relay solenoid and also provide the dc power for the warning circuits.



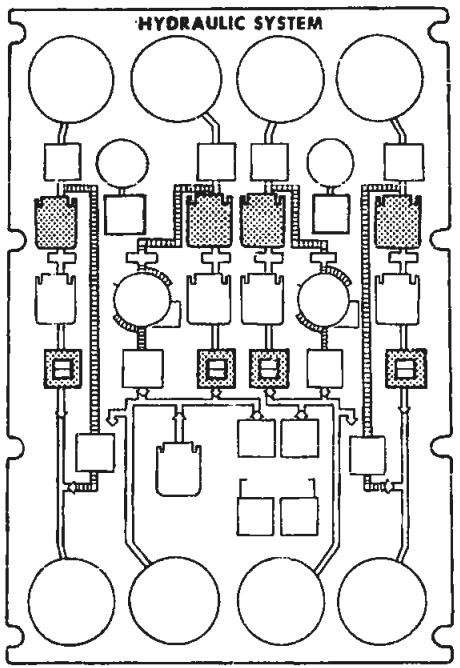
(D)
ACCESSORY SECTION
NO. 2 ENGINE
LEFT SIDE SHOWN
RIGHT SIDE OPPOSITE



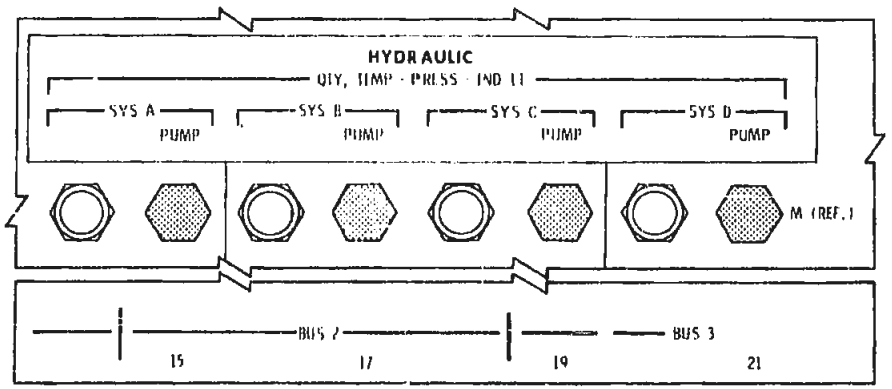
(H)
HIGH PRESSURE FILTER



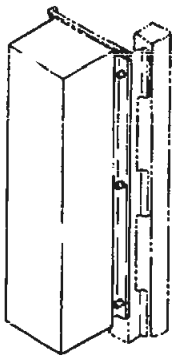
(I)
SINGLE BOWL CASE DRAIN FILTER



(E)
HYDRAULIC SYSTEM CONTROL PANEL



(F)
FLIGHT ENGINEER/SECOND OFFICERS
OVERHEAD CIRCUIT BREAKER PANEL CB2

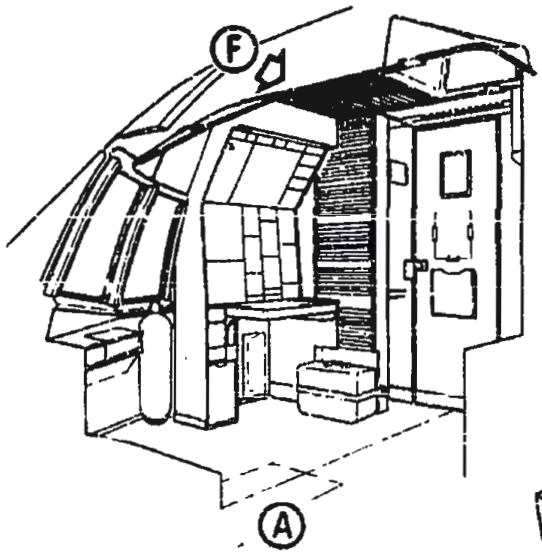


(G)
INDICATOR LIGHTS CONTROL
BOX (REF. 33-17-00)

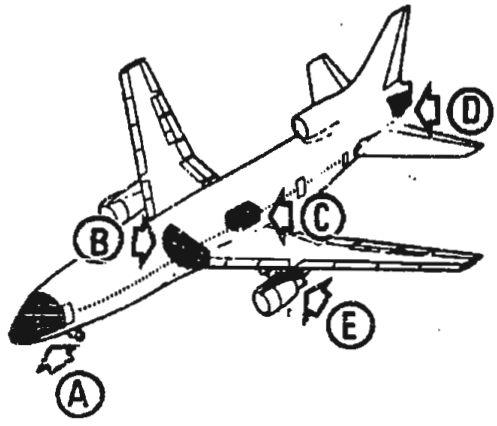
G362
M1-5101-29-120

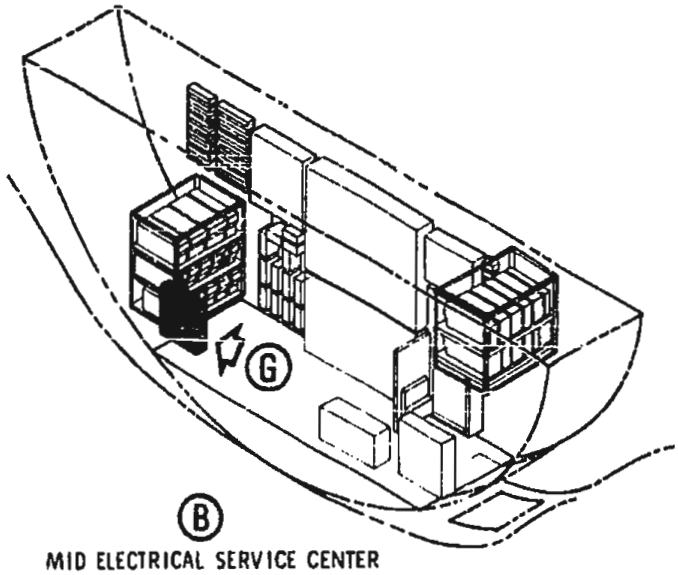
Primary Systems (Engine-driven Pumps) Caution Indicating System
Component Locator
Figure 4 (Sheet 2)

R

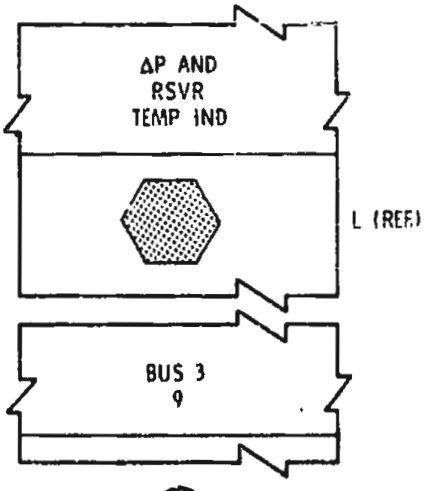


FLIGHT ENGINEER/SECOND OFFICERS STATION

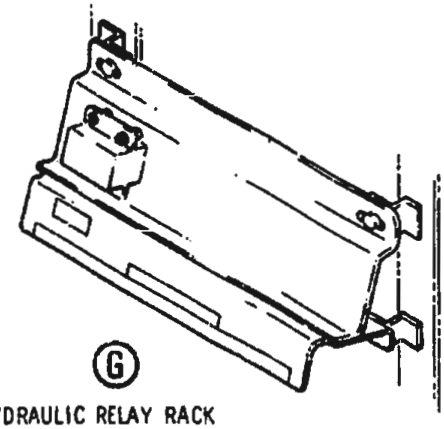




B
MID ELECTRICAL SERVICE CENTER



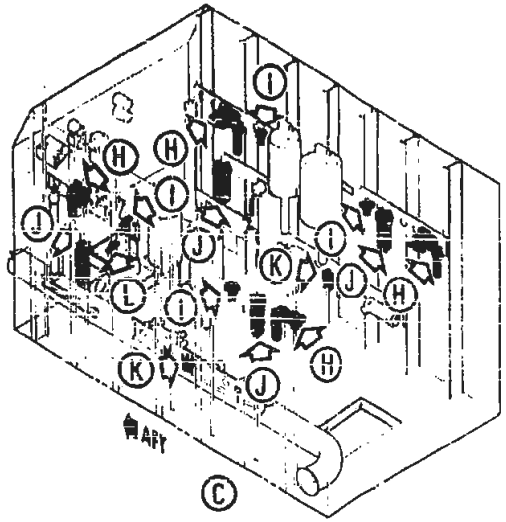
F
FLIGHT ENGINEER/SECOND OFFICERS
OVERHEAD CIRCUIT BREAKER PANEL
CB2



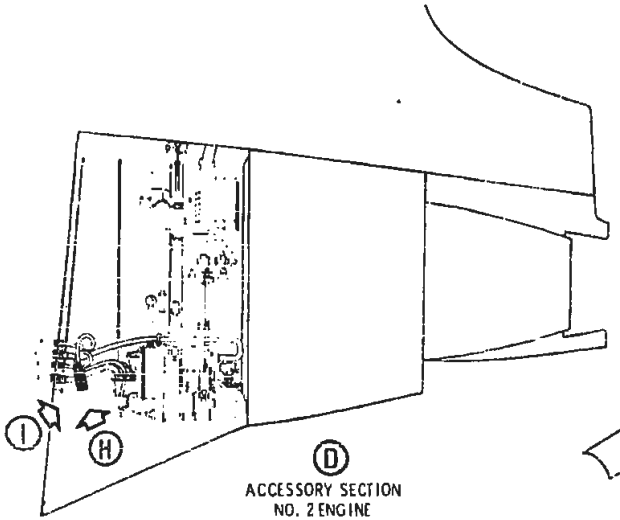
G
HYDRAULIC RELAY RACK
HYDRAULIC SERVICE CENTER DISARMING RELAY

HH 631c
M1-A00-29-104

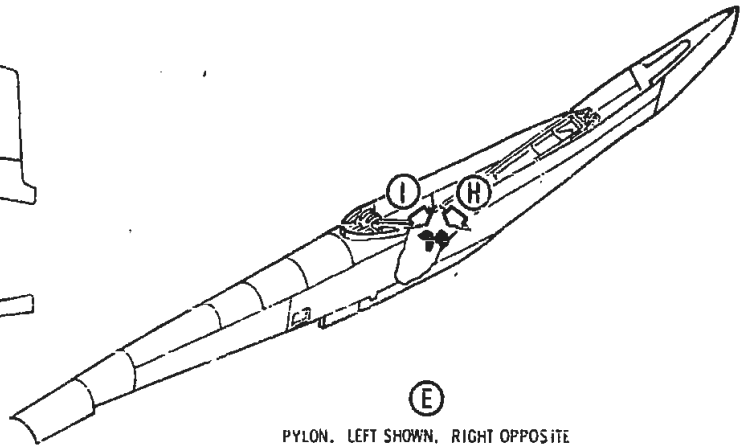
Filter Differential-pressure Caution Indicating System
Component Locator
Figure 5 (Sheet 1)



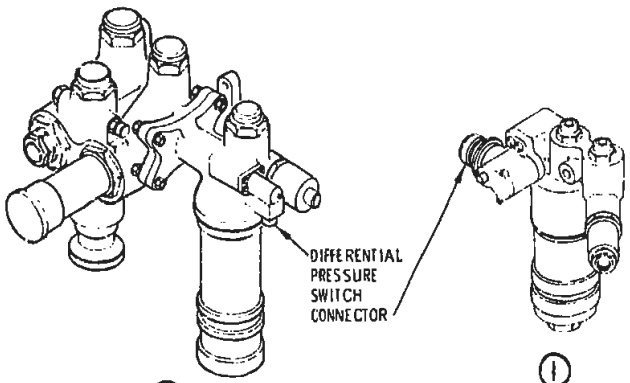
C
HYDRAULIC SERVICE CENTER



D
ACCESSORY SECTION
NO. 2 ENGINE
LEFT SIDE SHOWN. RIGHT SIDE OPPOSITE

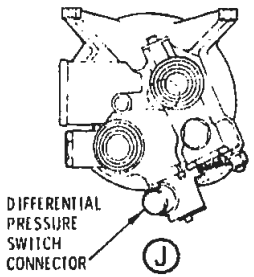


E
PYLON. LEFT SHOWN. RIGHT OPPOSITE

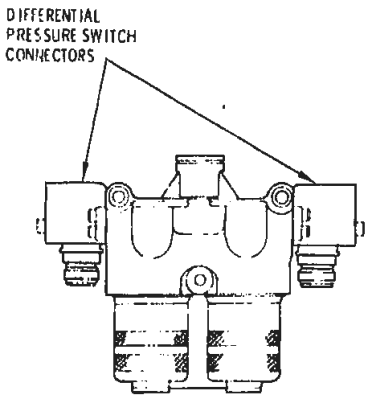


H
HIGH PRESSURE FILTER

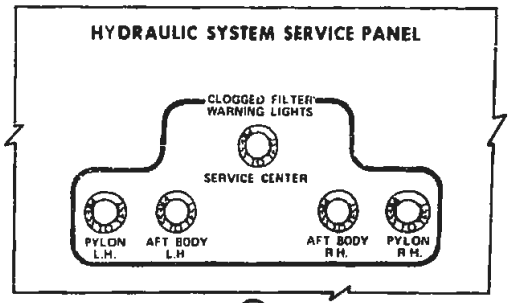
I
SINGLE BOWL CASE
DRAIN FILTER



J
RETURN FILTER
TOP VIEW



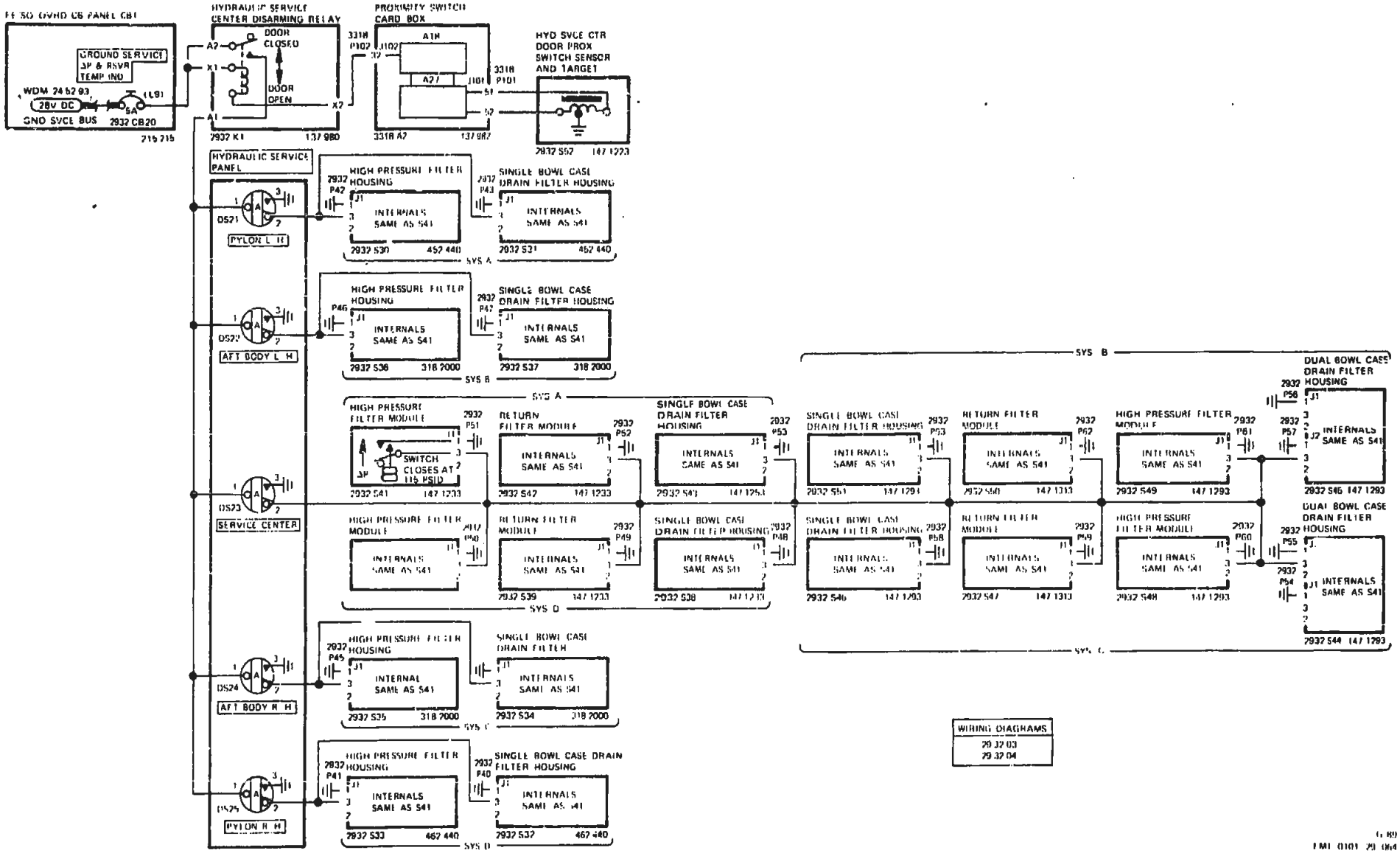
K
DUAL BOWL CASE
DRAIN FILTER



L
HYDRAULIC SYSTEM SERVICING PANEL
CLOGGED FILTER WARNING LIGHTS

G 351
M1-0101-29-105

Filter Differential-pressure Caution Indicating System
Component Locator
Figure 5 (Sheet 2)



R Filter Differential-pressure Caution Indicating System Schematic
R Figure 6

HYDRAULIC LOW-PRESSURE WARNING SWITCH - REMOVAL AND INSTALLATION

1. General

Removal and installation procedures for all low-pressure warning switches are essentially identical. The switches are installed on each engine-driven high-pressure filter housing assembly and on systems B and C high-pressure filter module for ATM-driven pump low-pressure warning. Switch locations and panel identifications are as follows:

Sys A High-pressure Filter - Left Pylon - 453DR

Sys D High-pressure Filter - Right Pylon - 463DL

Sys B and C High-pressure Filters - Aft Fuselage - Left and Right Lower Hinged Cowl Panels

Sys B and C High-pressure Filter Modules - Hydraulic Service Center, Left and Right Sidewall, Aft

2. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter or equivalent

Gasket (O-ring packing) LS 10116-10

Fluid Container (3 gallon)

R Hydraulic Service Cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

3. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that the following circuit breakers are open:

HYDRAULIC

INDICATORS - PRESS (M13)

SYS A PUMP (M15)

SYS B PUMP (M17)

SYS C PUMP (M19)

SYS D PUMP (M21)

ATM PUMP CONT & IND SYS B (L13)

ATM PUMP CONT & IND SYS C (L19)

(2) Open hydraulic service center access doors 147AB and 147BB.

WARNING: ENSURE THAT THE APPLICABLE HYDRAULIC SYSTEM IS SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(3) Gain access to the applicable filter assembly.

(4) Disconnect electrical connector from low-pressure warning switch (Ref. Fig. 401).

(5) Place fluid container in position to catch fluid leakage.

(6) Loosen and remove pressure switch from filter housing.

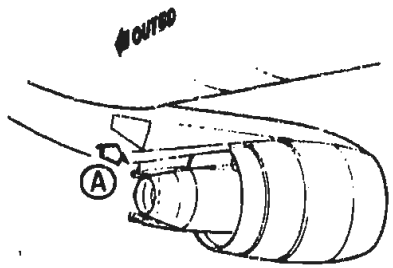
(7) Install plug in housing if replacement pressure switch is not installed immediately.

B. Installation

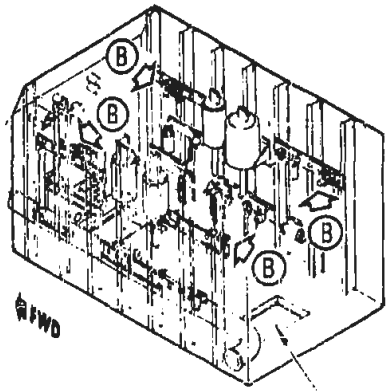
(1) Clean pressure switch port in filter housing.

(2) Install new O-ring gasket on replacement pressure switch and lubricate with hydraulic fluid.

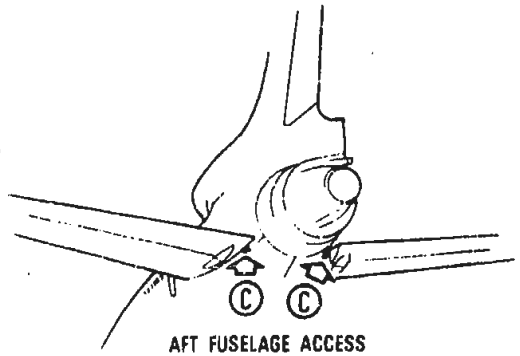
(3) Install pressure switch assembly in filter housing; tighten and lock-wire.



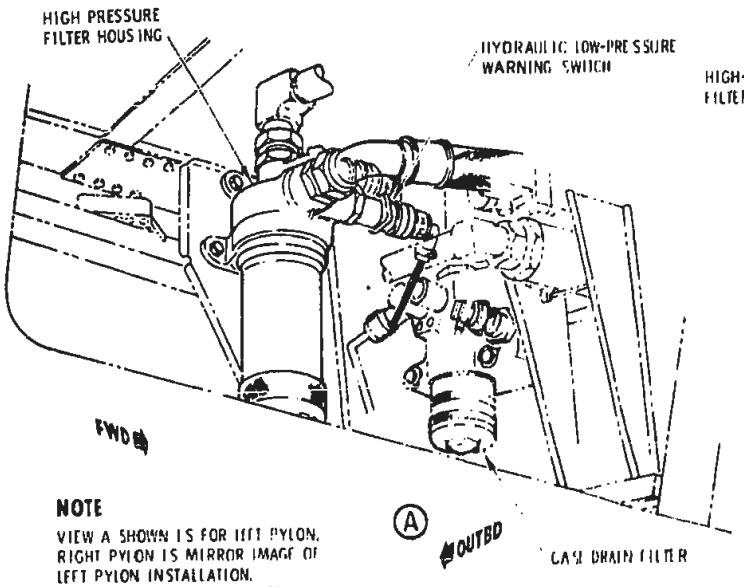
LEFT PYLON ACCESS PANEL 453DR
RIGHT PYLON ACCESS PANEL 463UL



HYDRAULIC SERVICE CENTER
AFT ACCESS DOOR (147BB)

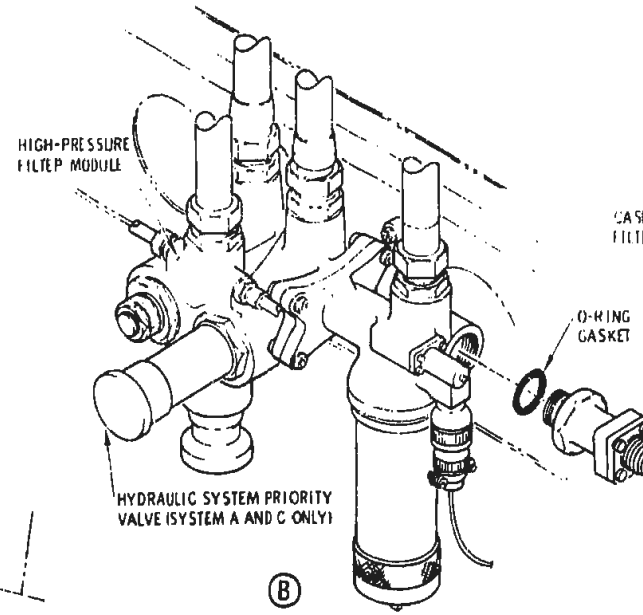


AFT FUSELAGE ACCESS
LOWER HINGED COWL PANELS



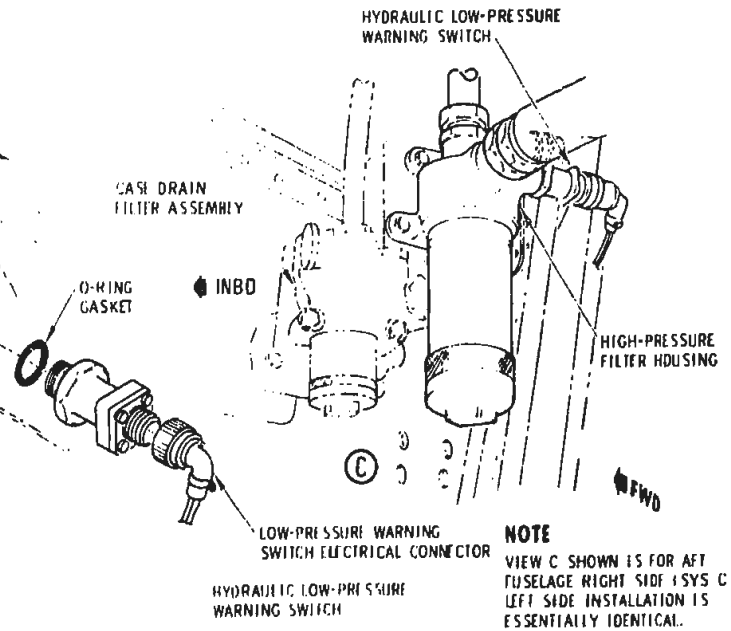
NOTE

VIEW A SHOWN IS FOR LEFT PYLON. RIGHT PYLON IS MIRROR IMAGE OF LEFT PYLON INSTALLATION. ACCESS PANEL IS ON INBOARD SIDE OF EACH PYLON.



NOTE

VIEW B SHOWN IS FOR LOW-PRESSURE WARNING SWITCH ON HIGH-PRESSURE FILTER MODULE. INSTALLATION IS TYPICAL FOR (A) AND (C).



NOTE

VIEW C SHOWN IS FOR AFT FUSELAGE RIGHT SIDE (SYS C). LEFT SIDE INSTALLATION IS ESSENTIALLY IDENTICAL.

MJ-0100-29-232

R Hydraulic Low-pressure Warning Switch - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

CASE DRAIN THERMAL SWITCH - REMOVAL AND INSTALLATION

1. General

Removal and installation procedures for all case drain thermal switches are essentially identical except for location and access. The switches are installed on each engine and ATM-driven pump case drain filter assembly. Switch locations and access panel identifications are as follows:

Sys A Case Drain Filter - Left Pylon - 453DR

Sys B and C Case Drain Filters - Aft Fuselage - Left and Right Lower Hinged Cowl Panels

Sys D Case Drain Filter - Right Pylon - 463DL

Sys B and C ATM-driven Pump Case Drain Filter - Hydraulic Service Center Left and Right Sidewalls

2. Equipment and Materials

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter or equivalent

Gasket (O-ring packing) LS 10116-10

Fluid Container (3 gallons)

R Hydraulic Service Cart, Western Fluidics P/N 5000-55G-74ASK, or equivalent

3. Referenced Procedures

12-13-01	Hydraulic Fluid Replenishing
24-41-00	External Power/Ground Service System Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that the following circuit breakers are open:

R

HYDRAULIC - QTY TEMP PRESS IND LT

SYS A PUMP (M15)

SYS B PUMP (M17)

SYS C PUMP (M19)

SYS D PUMP (M21)

ATM PUMP CONT & IND SYS B (L13)

ATM PUMP CONT & IND SYS C (L19)

(2) Open hydraulic service center access doors 147AB and 147BB.

WARNING: ENSURE THAT THE APPLICABLE HYDRAULIC SYSTEM IS SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(3) Gain access to the applicable filter assembly.

(4) Disconnect electrical connector from thermal switch (Ref. Fig. 401).

(5) Place fluid containers in position to catch fluid leakage.

(6) Loosen and remove thermal switch from filter housing.

(7) Install plug in housing if replacement thermal switch is not installed immediately.

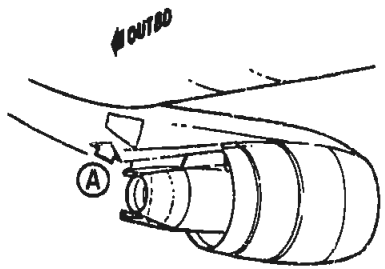
B. Installation

(1) Clean thermal switch port in filter housing.

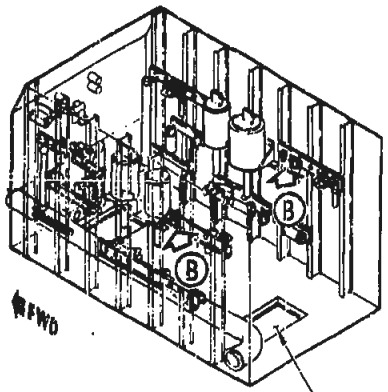
(2) Install new O-ring gasket on replacement thermal switch and lubricate with hydraulic fluid.

(3) Install thermal switch in filter housing; tighten and lock-wire.

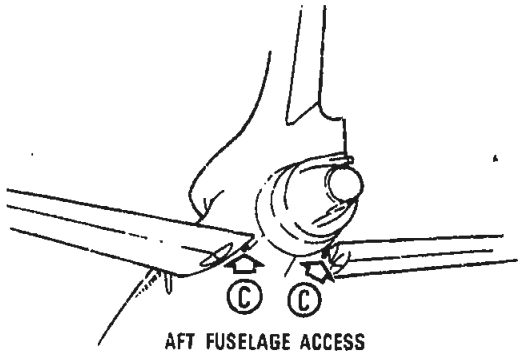
(4) Attach electrical connector.



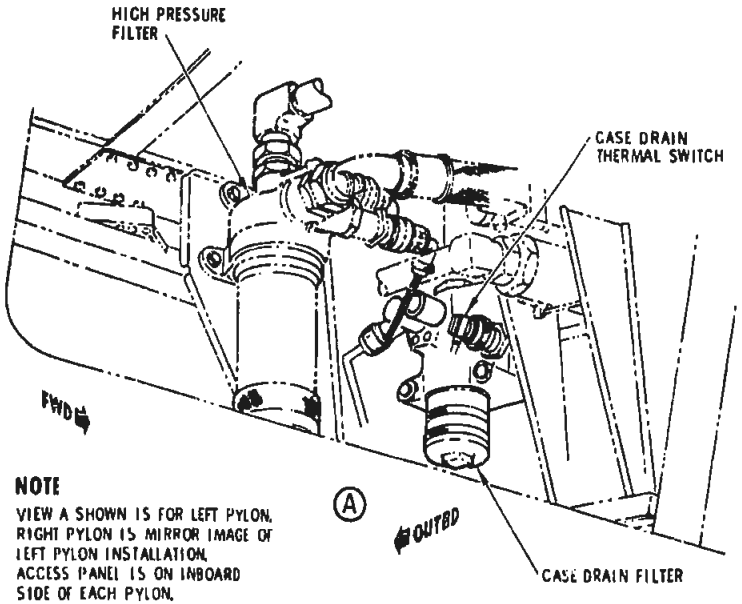
LEFT PYLON ACCESS PANEL 453DR
RIGHT PYLON ACCESS PANEL 463DL



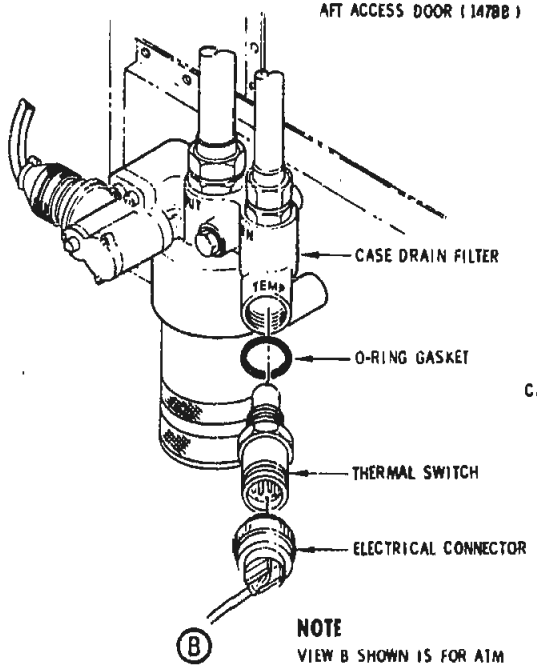
HYDRAULIC SERVICE CENTER
AFT ACCESS DOOR (1478B)



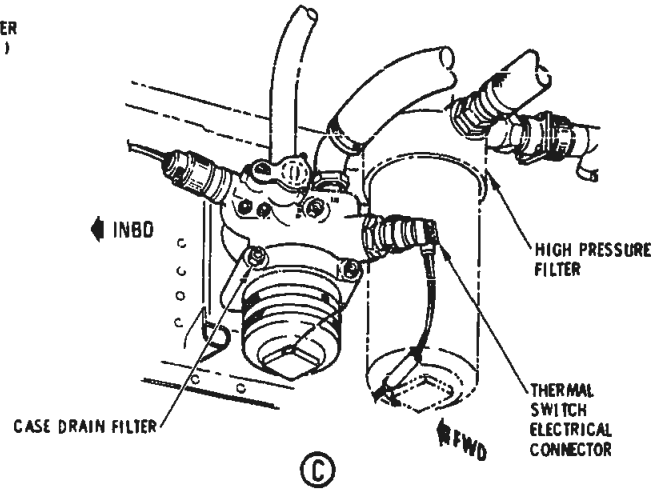
AFT FUSELAGE ACCESS
LOWER HINGED COWL PANELS



NOTE
VIEW A SHOWN IS FOR LEFT PYLON. RIGHT PYLON IS MIRROR IMAGE OF LEFT PYLON INSTALLATION. ACCESS PANEL IS ON INBOARD SIDE OF EACH PYLON.



NOTE
VIEW B SHOWN IS FOR ATM CASE DRAIN. THERMAL SWITCH INSTALLATION IS TYPICAL FOR (A) AND (C)



NOTE
VIEW C SHOWN IS FOR AFT FUSELAGE RIGHT SIDE (SYS C) LEFT SIDE INSTALLATION IS ESSENTIALLY IDENTICAL

M1-0100-29-233

R Case Drain Thermal Switch - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

R (4) Install electrical connector.

R (5) Close circuit breakers opened in Step 4A(1).

R (6) Turn on electrical power (Ref. 24-41-00).

R (7) Observe that the applicable system LO PR light is on
R (for ATM LO PR light operation, ATM rotary switch must
R be in ON position).

R (8) Pressurize applicable system and check for leakage
R (Ref. 29-11-00).

R NOTE: For engine-driven pump low-pressure warning
R switches, check for leakage at next engine run.
R For ATM-driven pump low-pressure switches, the
R high-pressure filter modules may be pressurized
R with the AC pumps.

R (9) Check applicable system reservoir fluid level and air
R bleed check (Ref. 12-13-01).

R (10) Turn off electrical power (Ref. 24-41-00).

R (11) Remove tags from hydraulic panels.

R (12) Close access panels and hydraulic service center doors.

(5) Close circuit breakers opened in Step 4A(1).

(6) Turn on electrical power (Ref. 24-41-00).

(7) Pressurize applicable hydraulic system and check for leakage (Ref. 29-11-00).

(8) Check applicable system reservoir fluid level and perform air bleed check (Ref. 12-13-01).

(9) Turn off electrical power (Ref. 24-41-00).

(10) Remove tags from hydraulic panels.

(11) Close access panels and hydraulic service center doors.

RESERVOIR THERMAL SWITCH - REMOVAL AND INSTALLATION

1. Equipment and Materials

   O-ring, LS10116-10, or equivalent

   Fluid container (6 gallons minimum for systems A, B, and D, and 10 gallons for system C)

   Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter or equivalent

   Protective caps and plugs

2. Referenced Procedures

12-13-00	Hydraulic Fluid Replenishing - Servicing
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

   A. Removal

      (1) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit
R breaker (DELTA) P and RSVR TEMP IND (L9).

      (2) Open hydraulic service center access doors 147AB and 147BB.

      (3) Verify that applicable hydraulic system is shut off (Ref. 29-11-00). Tag Flight Engineer/Second Officers HYDRAULIC SYSTEM, zone 215, and HYDRAULIC SERVICE PANEL, zone 147.

      (4) Position fluid container under applicable reservoir drain port and remove drain plug. Open air bleed valve at bottom of reservoir pressurization cylinder and drain reservoir (Ref. Fig. 401).

      (5) Disconnect electrical connector from reservoir thermal switch (high-temperature) located on bottom of reservoir.

      (6) Remove thermal switch from reservoir.

(7) Place protective caps and plugs on electrical plugs and reservoir thermal switch opening.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

(2) Verify that hydraulic system pressure is off and that controls are tagged.

(3) Remove protective caps and plugs.

(4) Lubricate O-ring and thermal switch threads with hydraulic fluid; install switch in reservoir and lock-wire.

(5) Connect electrical connector and lock-wire.

(6) Remove tag and close circuit breaker opened in Step 3A(1).

(7) Turn on electrical power (Ref. 24-41-00).

(8) Fill and bleed reservoir (Ref. 12-13-00).

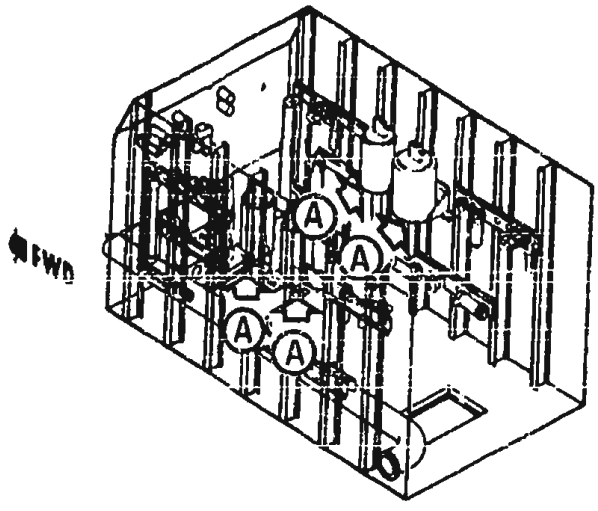
(9) Remove tags from controls and turn on applicable system hydraulic power (Ref. 29-11-00).

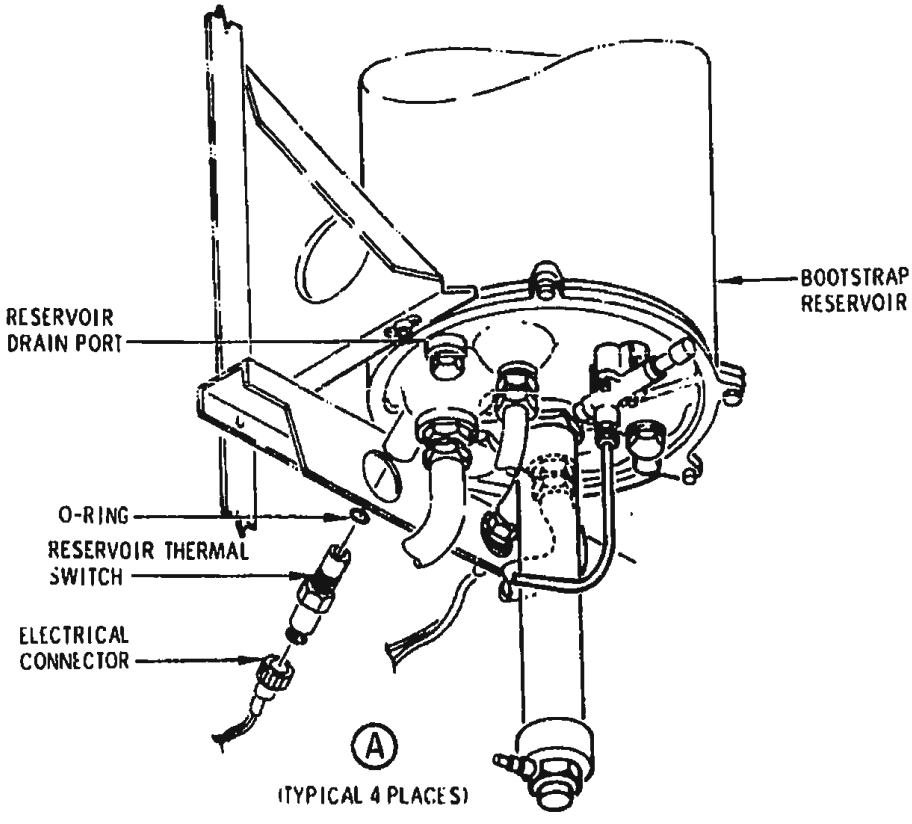
(10) Check reservoir thermal switch installation for leakage.

(11) Turn off hydraulic power (Ref. 29-11-00).

(12) Turn off electrical power (Ref. 24-41-00).

(13) Close hydraulic service center access doors 147AB and 147BB.





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MI-0100-29-169

Reservoir Thermal Switch - Removal and Installation
Figure 401

DIFFERENTIAL PRESSURE INDICATOR SWITCH - REMOVAL AND INSTALLATION

1. General

The removal and installation procedures are identical for all indicator switches installed on high-pressure return or case drain filter assemblies. Location of the filters is as follows: The high-pressure and case drain filters for engine-driven pumps are in the left and right pylons, zone 453, 463, and in aft fuselage, zones 433 and 434. The remaining filters are located in the hydraulic service center, zone 147.

CAUTION: DO NOT MANUALLY ACTUATE RED INDICATOR BUTTON TO EXTENDED (TRIPPED) POSITION. MANUAL ACTUATION WILL PERMANENTLY DAMAGE UNIT.

2. Equipment and Materials

Fluid container (3-gallon)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

3. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, open and tag circuit breaker GROUND SERVICE (delta) P & RSVR TEMP IND(L9). R

(2) Tag the applicable hydraulic system controls on the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147, to prevent pressurization of the system during switch removal and installation.

(3) Gain access to the applicable filter assembly and disconnect electrical connector.

(4) Position container to catch fluid drainage.

(5) Remove switch mounting cap screws.

(6) Remove switch assembly from filter manifold.

B. Installation

(1) Verify that circuit breaker opened in Step 4A(1) and system controls tagged in Step 4A(2) are as required.

(2) Check that manifold switch cavity is clean and O-ring and backup rings on switch assembly are in proper position and lubricated with hydraulic fluid.

(3) Insert switch assembly into filter manifold, tighten cap screws and lock-wire.

(4) Connect electrical harness plug to switch receptacle.

(5) Remove tag and close circuit breaker opened in Step 4A(1), and remove tags installed on system controls in Step 4A(1).

(6) Open hydraulic service center access doors 147AB and 147BB.

(7) Pressurize applicable hydraulic system (Ref. 29-11-00).

(8) Check filter/switch assembly for leakage.

(9) Turn off hydraulic system (Ref. 29-11-00).

(10) Turn off electrical power (Ref. 24-41-00).

(11) Close and lock hydraulic service center doors.

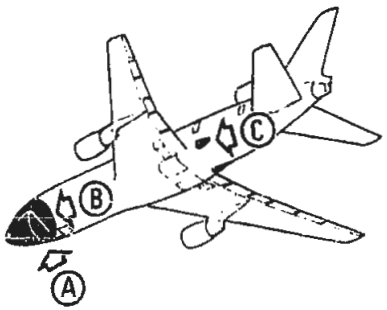
AIR TURBINE MOTOR INDICATING SYSTEM - DESCRIPTION AND OPERATION

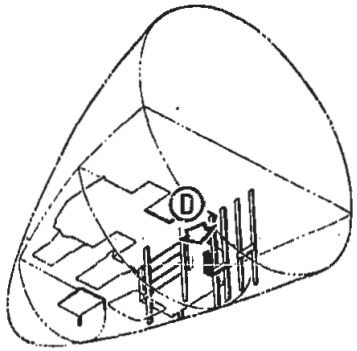
1. General

The air turbine motor (ATM) indicating system consists of a tachometer and a LUBE HI TEM/LO PR caution indicator light for each ATM. The tachometers and caution lights are on the HYDRAULIC SYSTEM control panel, zone 215, (Ref. Fig. 1). The tachometer magnetic pickups, lubrication underpressure and high-temperature switches are installed on each ATM in the right and left fairings, zones 196 and 195. The ATM controller (Ref. 29-11-00) is in the mid electrical service center, zone 137.

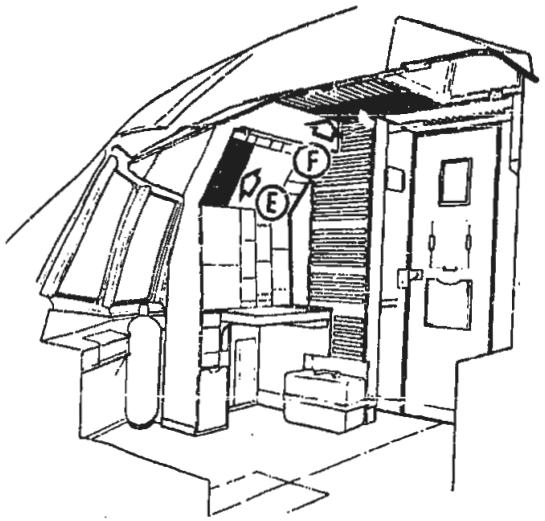
2. Operation

R The magnetic pickups on the ATM system B turbine and the ATM
R system C turbine energize their respective logic circuits in the
R ATM controller. The output from the controller ranges from 0 to 5V dc to energize the pointer coil in the tachometer. The nominal rate of 3700 rpm requires a controller output of 4V dc.
R The low-pressure switches and the high-temperature switches are
R set to close at predetermined values to complete the circuits to
R light the LUBE HI TEM/LO PR caution indicator lights on the HYDRAULIC SYSTEM control panel.

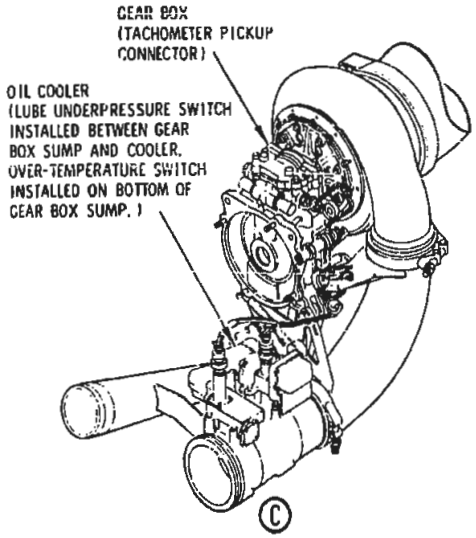




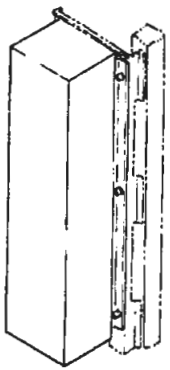
(A)
FORWARD ELECTRONIC SERVICE CENTER



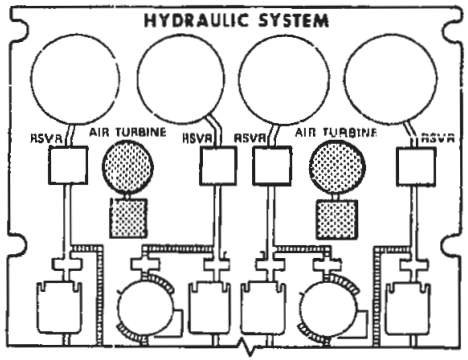
(B)
FLIGHT ENGINEER/SECOND OFFICERS STATION


GEAR BOX (TACHOMETER PICKUP CONNECTOR)
OIL COOLER (LUBE UNDERPRESSURE SWITCH INSTALLED BETWEEN GEAR BOX SUMP AND COOLER. OVER-TEMPERATURE SWITCH INSTALLED ON BOTTOM OF GEAR BOX SUMP.)

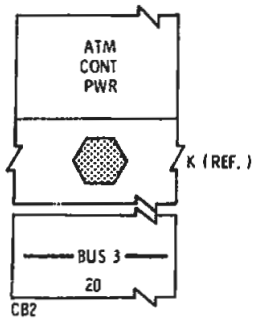
(C)
TYPICAL RH OR LH SIDE



(D)
INDICATOR LIGHTS CONTROL BOX



(E)
HYDRAULIC SYSTEM CONTROL PANEL



(F)
FLIGHT ENGINEER/SECOND OFFICERS OVERHEAD CIRCUIT BREAKER PANEL CB2

G353
M1-A00-29-106

ATM Tachometer and Lube Caution Indicating System Component Locator Figure 1

AIR TURBINE MOTOR INDICATING SYSTEM - MAINTENANCE PRACTICES

1. Deactivation

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

When the normal indication system for the ATM is inoperative, verification that the ATM is fully operative can be determined by performing the Air Turbine Motor Adjustment and Test procedures (Ref. 29-11-39).

QUIESCENT FLOW INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

CR Maintenance of the electrical portion of the quiescent flow
CR indicating system is not required. System is not used.
CR Electrical wiring may be disconnected, taped and stowed.

The quiescent flow indicating system monitors for gradual deterioration or failure of each valve in the hydraulic-actuated primary flight control system and case drain outlet lines of the six hydraulic pumps. There are 38 flowmeters in the hydraulic system. There are five flow rates measured in the system. Each flowmeter measures a specific flow rate. Each flowmeter circuit in the left wing and direct-lift control ends at one of two 29-pin connectors in the hydraulic service center, zone 147. Each flowmeter circuit in the right wing, ATM case drains and nosewheel steering servo ends at the other 29-pin connector. The flowmeter circuits from rudder servos, horizontal stabilizer, and hydraulic system B and C case drain lines ends at a 24-pin connector in the aft electronic service center, zone 164. An airborne integrated data system (AIDS) unit is plugged into each connector to record measurements during flight.

The right and left wing primary flight control hydraulic lines, two air turbine motor (ATM) pump case drains, and system A and D motor-driven pumps case drain quiescent flowmeters operate on 115V, 400-Hz, Phase B power from the passenger service bus 3L (QFM PWR). The rudder, horizontal stabilizer, and system B and C motor-driven pumps case drain quiescent flowmeters operate from phase A of the passenger service bus 1R (APU ETI).

Figure 1 includes the statistics and locations for each quiescent flowmeter.

2. Quiescent Flowmeter

A. Description

The quiescent flowmeter is a differential pressure device which measures fluid leakage past a servo valve when the hydraulic servo system is at null (Ref. Fig. 2). It consists of a spring-loaded piston with a calibrated orifice. The piston is connected to a square root function variable displacement transducer. The transducer senses the piston position. The output voltage is in direct proportion to hydraulic fluid rate of flow, which is the square root of pressure.

QUIESCENT FLOWMETERS

TABLE 1

HYDRAULIC FUNCTION	HYD SYS	LINE SIZE (IN.)	FLOW RATE (GPM)	OUTPUT SIG IN VAC/GPM	SIG RANGE IN VAC	LOCATION (ZONE)
DIRECT LIFT CONTROL						
DIR LIFT CONT	A	3/8	0.2-1.0	10.0	2.0-10.0	147
	B	3/8	0.2-1.0	10.0	2.0-10.0	147
NOSE WHEEL STEERING						
DELETED						
LEFT WING						
OUTBD AIL.	A	1/2	0.36-2.5	4.0	1.44-10.0	572
OUTBD AIL.	B	1/2	0.36-2.5	4.0	1.44-10.0	572
NO. 6 SPOILER	B	3/8	0.2-1.0	10.0	2.0-10.0	565
NO. 5 SPOILER	C	3/8	0.2-1.0	10.0	2.0-10.0	564
NO. 4 SPOILER	B	3/8	0.2-1.0	10.0	2.0-10.0	563
NO. 3 SPOILER	C	3/8	0.2-1.0	10.0	2.0-10.0	562
INBD AIL.	A	1/2	0.36-2.5	4.0	1.44-10.0	552
INBD AIL.	B	1/2	0.36-2.5	4.0	1.44-10.0	552
INBD AIL.	C	1/2	0.36-2.5	4.0	1.44-10.0	552
NO. 2 SPOILER	A	3/8	0.2-1.0	10.0	2.0-10.0	544
NO. 1 SPOILER	B	3/8	0.2-1.0	10.0	2.0-10.0	543
RIGHT WING						
OUTBD AIL.	D	1/2	0.36-2.5	4.0	1.44-10.0	672
OUTBD AIL.	B	1/2	0.36-2.5	4.0	1.44-10.0	672
NO. 6 SPOILER	B	3/8	0.2-1.0	10.0	2.0-10.0	665
NO. 5 SPOILER	C	3/8	0.2-1.0	10.0	2.0-10.0	664
NO. 4 SPOILER	B	3/8	0.2-1.0	10.0	2.0-10.0	663
NO. 3 SPOILER	C	3/8	0.2-1.0	10.0	2.0-10.0	662
INBD AIL.	D	1/2	0.36-2.5	4.0	1.44-10.0	652
INBD AIL.	B	1/2	0.36-2.5	4.0	1.44-10.0	652
INBD AIL.	C	1/2	0.36-2.5	4.0	1.44-10.0	652
NO. 2 SPOILER	D	3/8	0.2-1.0	10.0	2.0-10.0	644
NO. 1 SPOILER	B	3/8	0.2-1.0	10.0	2.0-10.0	643
EMPENNAGE						
RUDDER SERVO	C	1/2	0.36-2.5	4.0	1.44-10.0	317
RUDDER SERVO	A	1/2	0.36-2.5	4.0	1.44-10.0	317
RUDDER SERVO	B	1/2	0.36-2.5	4.0	1.44-10.0	317
HORIZ STAB.	A	1	0.5-3.5	2.86	1.4-10.0	317
HORIZ STAB.	B	1	0.5-3.5	2.86	1.4-10.0	317
HORIZ STAB.	C	1	0.5-3.5	2.86	1.4-10.0	317
HORIZ STAB.	D	1	0.5-3.5	2.86	1.4-10.0	317
CASE DRAINS						
ENG NO. 1 PUMP	A	5/8	1.4-7.0	2.0	2.8-14.0	551
ENG NO. 2 PUMP	B	5/8	1.4-7.0	2.0	2.8-14.0	317
ENG NO. 2 PUMP	C	5/8	1.4-7.0	2.0	2.8-14.0	317
ENG NO. 3 PUMP	D	5/8	1.4-7.0	2.0	2.8-14.0	651
ATM PUMP	B	5/8	1.4-7.0	2.0	2.8-14.0	147
ATM PUMP	C	5/8	1.4-7.0	2.0	2.8-14.0	147

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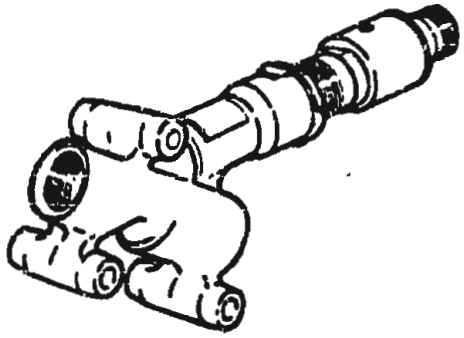
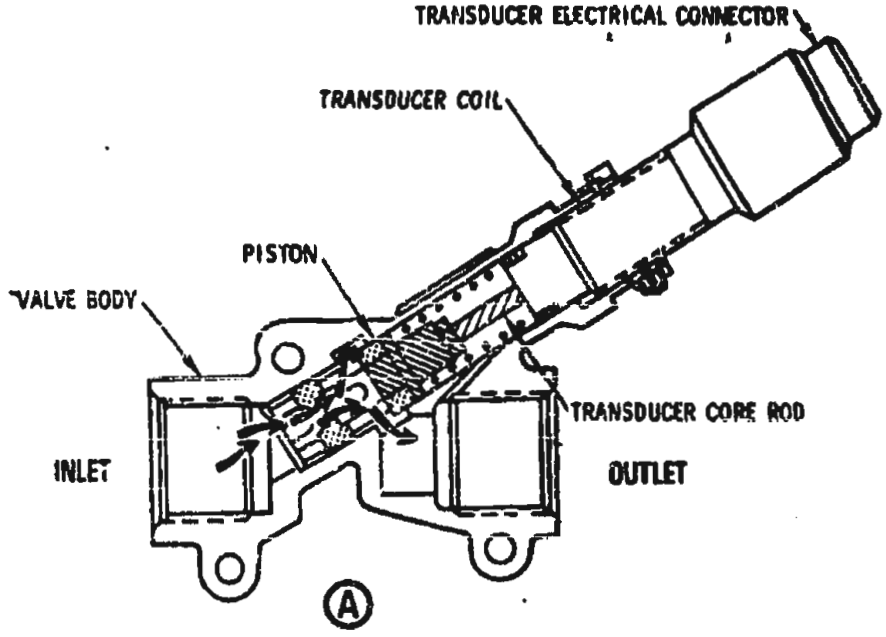
CR Quiescent Flowmeter Chart
CR Figure 1

EFFECTIVITY: ALL

001B

Transducer adjustment or replacement on the aircraft should not be attempted. Calibration of the transducer can only be made on a test stand.





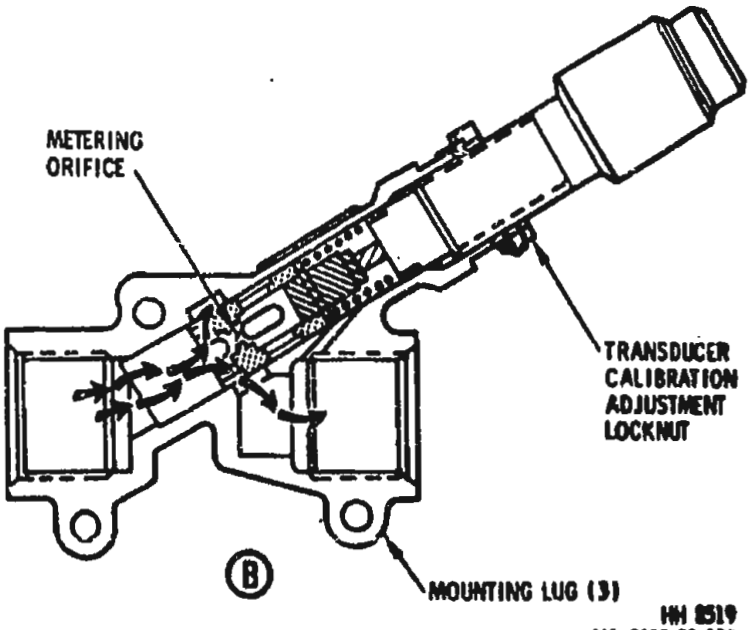
NOTE:

(A) METERING CONDITION

SYSTEM QUIESCENT FLUID FLOWS THROUGH THE PISTON METERING ORIFICE. PISTON DISPLACEMENT CAUSED BY QUIESCENT FLOW DIFFERENCES IS AN INDICATION OF SYSTEM CONDITION. PISTON DISPLACEMENT PRODUCES CHANGES IN VOLTAGE INDICATION AS A RESULT OF TRANSDUCER CORE ROD POSITION.

(B) BYPASS CONDITION

NORMAL SYSTEM OPERATION RETURN FLUID FLOW DISPLACES PISTON ALLOWING THE HIGHER FLOW TO BYPASS THE METERING ORIFICE AND EXIT UNRESTRICTED THROUGH THE OUTLET AND INTO THE RETURN SYSTEM.



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Quiescent Flowmeter Functional Schematic
Figure 2